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EDITORIAL

RUBBER RESTRICTION AND REPLANTING

THIS number contains the second of a series of short articles on some practical aspects of rubber planting by the doyen discoverer of the method of budgrafting. These articles will be of especial interest at the present time when the second Scheme of Restriction of rubber has just been inaugurated by mutual arrangement between the various rubber producing countries, and which permits of a certain amount of replanting. The present Scheme has certainly several advantages over the first, the Stevenson Scheme. A great point is that it is the outcome of understanding between all the rubber producing countries of the East and thus is not a one-sided affair as was the former scheme, the only Eastern country not coming fully within the present restriction being French Indo-China. Further, the Scheme has come after a much more drastic stage of depression than was the case when the first scheme was instituted. Rubber has within the past few years reached a price far lower than at the time of the Stevenson Scheme, and at which it was then believed to be impossible to produce it. That Scheme came in with a bottom price that the growers would now almost regard as a handsome top one, the result was that whilst Ceylon and Malaya had not learnt the full economies of production, the

Dutch East Indies probably had and were reaping handsome profit from their unrestricted plantations in comparison with their self-denying neighbours. In the present Scheme restriction has been effected by mutual agreement as to certain quota which represent comparative potential maximum exports for each producing country for the next five years. An International Rubber Regulation Committee will from time to time review the situation and determine the percentage of these allotted quota which may be exported. Further planting of rubber is prohibited except for experimental purposes and then only to a limited extent of one per cent. of the quotum allowed to any territory. The Scheme makes provision for funds for research work for the furtherance of new uses for rubber, and allows replanting to be done on individual estates to the extent of twenty per cent. of the existing area. It is hoped that full advantage will be taken of this replanting facility in Ceylon to substitute at least the poorest yielders of areas, if not entire poor yielding areas, with better yielding material up to the extent allowed. Planting material is prohibited from export from one country to another but Ceylon should now be able to supply from trees under experimentation budwood of varieties which would greatly increase the yield of many of our plantations. Our plantations have been backward in realising the great possibilities of budgrafting but the advantages of this and much useful advice to be considered in carrying it out are set forth in Dr. Cramer's articles.

RUBBER

THE USE OF IMPROVED PLANTING MATERIAL— *(Contd.)*

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II. MONOCLONAL PLANTINGS

WHEN considering what clones we should use the first point to study is, of course, the yield. The difficulty is that the yield figures are not entirely comparable. Most of the experimental tapping is done in the various places according to the prevailing local tapping system. In Sumatra we find generally monthly alternation, daily tapping during the tapping months; in Java, alternate day tapping; in the experimental fields of the Rubber Experimental Station trees are always rested on Sundays. In the Dutch East Indies most tapping is with $\frac{1}{3}$ spiral, in Malaya with $\frac{1}{2}$ spiral or $\frac{1}{2}$ circumference V cut. The figures are often spread over various publications and it requires generally some work to come to a conclusion on the clonal yields. In this respect we may cite an excellent publication, due to the Rubber Research Institute, Kuala Lumpur, giving a complete description of the principal clones and details about yields, tapping system and also growth and other secondary characters.—(The History and Description of Clones of *Hevea Brasiliensis* by C. E. T. Mann and C. C. T. Sharp).

Often the question is put to me: What do you consider the best clone ? On such a question one has to answer with a question: for what conditions ? for what purpose ? There are clones better suited to a dry climate, BD 5 for instance, and other ones which are more wet-climate clones, like Avros 256.

Some of our highest yielding clones, like Sabrang 24, do not offer the same certainty as the medium producers, like Avros 49 and 152. Among the Prang Besar clones there are early high yielders and others taking some time before reaching a high figure. It is a matter of comparing what is wanted with what

the various clones can offer, and this cannot be done too carefully as the future results mainly depend on the careful choice of the clones to use.

Of course a plantation should never plant only one or two clones, but try to divide the risk by using several clones. In its original form the system was to mix several clones in the same field. When it comes to thinning out these mixed plantings people realise that it would have been better to start from the very beginning with monoclonal planting. It is extremely difficult to remove one or two clones from such a mixture of eight or ten clones and if we only go by individual yields, we run the risk of taking out not the poorest yielders, but the clones coming later to a higher yield than others. In a pure monoclonal planting the thinning out is still easier, than in a seedling field. We can limit ourselves to taking out the poorly growing or yielding trees. The monoclonal planting has many other advantages: the tapping system can be exactly adapted to the clone and the tapper will always have the same quality of bark under his knife. As a last advantage we may say that the monoclonal blocks will give us practically pure monoclonal seeds which can be collected without any special attention given to the trees from which they come. The only condition for monoclonal planting is that we must very carefully consider the various clones, their advantages and disadvantages before we take our decision. Of course the whole of the problem has to be considered. A small estate starting with a few dozens of acres as a new extension under buddings will limit itself to some of the well studied Avros clones giving a good deal of certainty; a large company which has opened thousands of acres with budded rubber can afford to include in its programme a hundred acres of a new clone, more uncertain as yet, but offering the possibility of very high yields. There is now such a variety of clones on the market that one can find some for each case. Generally speaking a number of at least 4 or 5 will offer a good distribution of the risk, but every year the well established clones become more and more certain and may obtain therefore a larger place when the various areas and the clones to be used in them are planned. By allotting to the better *Hevea* clones a larger area by limiting the acreage under the more uncertain ones we can compensate more or less the *pros* and *cons*. After all our programme can only reflect the state of our knowledge as it was at the moment of deciding on our plan.

In late years the production of new clones seems to have come to a standstill; in 1932-33 very few new ones have been added to the list; but for some younger ones, like the interesting Pilmoor clones in Malaya, the figures will become more convincing as we may perhaps see later. The experiment stations are again turning a good deal of their attention to seedling selection and the young extensions after 1920, which should furnish us now with mother trees for new clones have been relatively few. There is a sort of balancing action between the two systems of improvement; if we want to go on with the seedling improvement we will have to use clonal seeds and for improvement we will want new clones; for arriving at new clones we will have to select among seedlings and so we want to see new fields laid out with seedlings. "Restriction" will not stimulate the making of large extensions but it may not prevent the substitution of better material. We may expect that the improvement of planting material will come somewhat to a standstill for a time, when it will be taken up again, a new area of seedling planting may follow, but we shall probably see some budgratting going on also, were it only to arrive at better seeds and to help seedling selection to progress further.

III. SECONDARY CHARACTERS

In our former chapters we have already explained that the character of primary importance that should guide our choice of the clones to be planted is the average yield figure. If this is true we should not neglect the secondary characters, like resistance to adverse conditions and diseases, growth, bark renewal, and so on.

In studying yield figures we must think of the conditions for which they were found. A clone which occasionally in a dry season has gone back heavily in yield, like Tjirandji 1. will not be recommendable for a very dry climate, unless other advantages compensate for this weak point. When the 90,000 acres of buddings were established in Indo-China not a single budding had ever been tapped in the country, nor a local clone been developed up to the tapping age. In this case the planters had to choose the clones to be introduced from the outside, simply by analogy. It was logical that clones like BD 5 and Avros 49 known as showing in their country of origin a strong resistance against drought (not only in relation to growth, but also in relation to production) were given a larger place in the planting programme than clones like Tjirandji 1. and Avros 256. I agree that with all this material we ran a certain risk, but since

the end of 1933 a few trees originally introduced as buddings from Java and planted on a few estates in Indo-China have been tapped experimentally, and the results confirm our views.

It seems probable that Tjirandji 1. will show under the extremely dry conditions of Indo-China (often five months without a drop of rain) a heavy fall in its yield, but the very high yield of this clone during the wet season may make up for this. But, it is clear that in general we will choose for a dry climate a clone which shows among its secondary characters a good resistance against drought. In a comparative test containing a series of Java, Sumatra and Malayan clones in Indo-China we find up till now that Tjirandji 3. is the most vigorous grower.

Another climatic factor is wind. When the trees begin to develop their dense crown, when they are 3 or 4 years old, they are particularly subject to wind damage. This is also true for common *Hevea* seedlings. Some curious figures about the resistance to breakage by wind have been published recently by the Avros Experiment Station in Sumatra. When I discussed them with the Director, Dr. d'Angremond, during a recent visit to the station in Sumatra he asked me: did you ever realise that *Hevea* is a tree very subject to breakage by wind and in connection with it he emphasised the fact that by a lucky chance among the first clones developed some have turned out afterwards to be extremely resistant against wind. Already in the early days of the Avros clones, Avros 36 was found to suffer heavily from wind and was discarded for that reason on many estates. From the observations by M. Schmole of the Avros Station storms do practically no harm to clones like Avros 49 and 50. Among the Java clones BD 5 is particularly resistant to wind; Tjirandji 1. on the other hand is well known to be very subject to it. I have seen cases where in young fields of Tjirandji 1. just put into tapping 30 per cent. had been severely damaged by wind.

In this connection another point may be mentioned, which is of importance for places where rubber is combined with other crops, the density of the crown. With clones like Avros 50 and BD 5 the crown of a tappable tree is still so open that plenty of light can come through. I have recently seen in Sumatra coffee fields interplanted 20 by 20 feet with Avros 50, 4 years old (girth about 15 in.) where the coffee did not yet suffer from too much shading by the rubber, while if the clone used had been

Tjirandji 1. or Avros 152, the field would have been already too densely shaded.

The resistance of clones against diseases is another secondary character of great practical importance. In a country like Indo-China where pink disease (*Corticium*) is one of the most dangerous diseases, appearing in 3 to 5 year old fields and damaging them to such a degree, that if no effective treatment is given in proper time they never will recover from the attack, a clone like Avros 50, well known as particularly subject to pink disease has to be left out. Brown Bast is another disease which is a bad mark for a clone; if found in the mother tree the buddings made from it are already suspect. If however, the yield of the clone is very high, it may be that tapping with a shorter cut, exhausting the tree less, and so avoiding the brown bast, may still give yields of an outstanding high figure.

Wound recovery and bark renewal are other secondary characters of importance. In many clones renewed bark has now been tapped and in some cases the yields were so high that people were considering if it would not pay to tap very early to have early tappable renewed bark.

The time when the tree becomes tappable may differ also a good deal in various clones. Normally the tendency will be to prefer clones which may be brought into tapping at an early age. Here again we must not go too far, and a well-made selection of various clones for the planting programme may compensate, for besides early yielders also some clones might be included, which arrive at their high yields only at an older age. From figures on young trees we expect that Tjirandji 1. is an early yielder, like Prang Besar 25, while Tjirandji 16 and BD 5 are much slower in coming up to a high level.

The way the buddings grow has also to be considered. We have ourselves been induced to plant out clones, giving in the first years good yields, which, when we saw afterwards the adult mother trees, appeared so poor, with bent, hanging over stems, and poor wound recovery, that we recommended that the one year old buddings should be rebudded. In such cases one should not hesitate to go back on an opinion, when good evidence shows that one has made a wrong choice.

A last point to be mentioned in the question of secondary characters is the suitability for being budded; Waringiana 4. has a bad reputation in this respect. This factor may vary a good

deal and so does the faculty to heal the union, which for instance will be much sooner perfect when buddings are made on three year old stocks, with clones like Avros 50 and 152 than with BD 5.

If a first rate clone presents difficulties with the budding, that should not be a reason to reject it, but only for paying special attention to the work. Generally there will be a tendency from the budders themselves up to the manager, to prefer easily budded clones, and we know of instances where it took quite a time to arrive at a complete stand of a difficult budder.

(*To be continued*).

Dendrobium Pierardi Roxb.

NOTES ON ORCHIDS CULTIVATED IN CEYLON

DENDROBIUM PIERARDI ROXB.

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THIS is a free flowering and easily grown species and should find a place in any orchid collection. It is indigenous to the northern parts of India where it thrives on the trunks of trees; it became popular among decorative plants when it was first introduced to the Calcutta Botanic Gardens by M. Pierard whose name it perpetuates.

The long pendulous stems often extend to six feet and more. The young pseudo-bulbs bear well-set shining green, lance-shaped, succulent leaves, four or five inches long and about one and a half inches broad.

A profusion of long-lived flowers is borne singly or in clusters up to four, on the mature leafless pseudo-bulbs nearly every third month. Each individual flower is rarely more than two inches across. The petals and sepals are waxy and a pale mauve, delicately tinged with rose and the broad flat labellum is of a buff primrose shade, with a downy upper surface, the throat being streaked with purple.

Culture.—It is not an uncommon sight to find the plant in young growth clothed with tender leaves, mature and bare pseudo-bulbs and others in bud or with clusters of fully opened flowers, at one and the same time. It is, therefore, very necessary that the compost used for this particular species should be fairly rich and also of a moisture-conserving texture suited to these requirements.

It thrives best in a mixture made up of sterilised coconut husk, flaky leaves, bones and dried cakes of cowdung in equal parts, finished off with a top-dressing of moss.

It is advisable to examine well-grown specimens frequently. Those that are completing their growth should be placed where more light can reach them, so that slightly drier conditions may

be maintained, although the plants should not suffer from dryness, as the roots will be very active, and any check received from a period of dryness will prevent them from completing their growth.

The plants are best cultivated in pans or wooden baskets and will display themselves to advantage when in bloom, if suspended from the roof.

After potting this orchid needs regular watering especially when young leafy shoots appear, but when the flower buds are developing on mature stems a gradual increase of heat and decrease of moisture will be needed to assist in the full development of flowers.

Owing to its free growing habit and subsequent drain on the compost, periodical top-dressings should be given and a complete overhauling made every second year.

Propagation of the stock can be effected by placing small balls of coir or moss near the young shoots that appear on the nude stems, and these may be removed when sufficiently rooted.

GINGER MANURIAL AND CULTURAL EXPERIMENTS

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INTRODUCTION

IN the May 1933 issue of this Journal an account was given of preliminary manurial trials carried out with ginger at Siyambalagoda in the Kandy district. The results obtained were so encouraging that it was decided to continue these trials on a more extensive scale. In addition to manurial experiments, varietal trials and experiments to determine the optimum seed rate for ginger and the best method of planting the crop for curing purposes were included in the experimental programme. The new trials were carried out at Giragama about five miles from Peradeniya in the centre of a ginger growing area. The experimental area was a fairly steep hillside, undulating in parts, but typical of ginger growing land in the Province. Plates I and II will give some idea of the nature of the land under experiment.

MANURIAL AND VARIETAL TRIALS

The manurial experiments were designed to determine (1) which of two varieties (the local and the Nugegoda—a degenerated type of Cochin ginger) was the better yielding, (2) the effect of manuring on yields and the relative efficacies of artificial and cattle manure on each variety, (3) the effect of liming, (4) the effect of a mulch of straw, and (5) the interaction between the various factors concerned.

DESIGN

The randomised block method of field experimentation was adopted owing to the large number of treatments involved and the varying configuration of the land. Three blocks each containing 24 randomised plots, one for each treatment, were

marked out so that, as far as possible, each plot ran down a slope of the hillside. This would be apparent from Plates I and II. The plots in a block were separated from each other by a drain one foot wide and four inches deep. Owing to the nature of the land the plots could not all have been of one shape, but they were all of the same size viz. 450 sq. ft. or one-ninety third of an acre approximately.

SOIL

The area had been uncultivated for several years and was thick with weeds prior to cultivation. The analysis of a representative sample of soil from the area, seen in Table I below, shows that it is a silty loam, well supplied with nitrogen and organic matter, and acidic in reaction. Due to its high clay content, it should be well supplied with potash. Compared with local soils it is definitely fertile and the comparatively high yield obtained from the control plots is therefore not surprising.

TABLE I

Mechanical Analysis

	%
Moisture	2·73
Coarse sand	21·75
Fine sand	24·87
Silt	27·50
Clay	21·25
Sesquioxides, etc.	·88
Difference	1·02
	100·00

Chemical Analysis

Nitrogen	·137
Loss on ignition	11·56
Reaction (PH)	6·5

TREATMENTS

The number of treatments was 24, made up of combinations of the following:

Varieties	2—	Nugegoda and local ginger
Manurial treatments	3—	No manure Cattle manure Artificial manure
Liming	2—	No liming Liming
Cultural treatments	2—	No mulch Straw mulch

Photo, Plate I. The nature of the land under experiment *L. S. Bertus*

Though there were only three replications of each treatment, the number of effective replications for comparisons of means of major treatments was considerably higher. Thus in the case of varieties the means of 36 plots are compared. So also with the comparison of liming against no liming and mulching against no mulch. Comparisons of the three manurial treatments are based on the means of 24 plots.

The complete set of treatments is shown in Table II below. In this and subsequent tables *N* will signify Nugegoda ginger, *G* local or Giragama ginger, *S* straw mulch, *L* lime, *C* cattle manure, and *A* artificial fertilisers.

TABLE II

Treatments

Number					Designation
1	Nugegoda	No manure	No lime	No straw	N
2	,,	,,	,,	Straw	N S
3	,,	,,	Lime	No straw	N L
4	,,	,,	,,	Straw	N L S
5	Local	,,	No lime	No straw	G
6	,,	,,	,,	Straw	G S
7	,,	,,	Lime	No straw	G L
8	,,	,,	,,	Straw	G L S
9	Nugegoda	Cattle manure	No lime	No straw	N C
10	,,	,,	,,	Straw	N S C
11	,,	,,	Lime	No straw	N L C
12	,,	,,	,,	Straw	N L S C
13	Local	,,	No lime	No straw	G C
14	,,	,,	,,	Straw	G S C
15	,,	,,	Lime	No straw	G L C
16	,,	,,	,,	Straw	G L S C
17	Nugegoda	Artificial manure	No lime	No straw	N A
18	Nugegoda	Artificial manure	No lime	Straw	N S A
19	,,	,,	Lime	No straw	N L A
20	,,	,,	,,	Straw	G L S A
21	Local	,,	No lime	No straw	G A
22	,,	,,	,,	Straw	G S A
23	,,	,,	Lime	No straw	G L A
24	,,	,,	,,	Straw	G L S A

PLANTING DETAILS

Lime was applied on the limed plots at the rate of 15 cwt. per acre three weeks before planting. Cattle manure was forked in at the rate of 2 cwt. per plot or 9·3 tons per acre, a day or two before planting. The artificial fertilizer consisting of a mixture of equal parts of sulphate of potash, sulphate of ammonia and superphosphate was applied at the rate of 6 lb. per plot or approximately 5 cwt. per acre, a day before planting. The seed ginger was divided into small sets and planted in holes 18 inches apart at the rate of 15 lb. per plot, there being 240 holes to a plot. The seed rate was therefore about 12·5 cwt. per acre. Paddy straw was used as a mulch at the rate of 15 bundles or about 40 lb. per plot, equivalent to 35 cwt. per acre.

The area had previous to blocking been mamoty-dug twice. Weeding was carried out periodically. The crop was planted between the 26th and 28th April, 1933 and harvested between the 8th and 12th January, 1934. Owing to the heavy rainfall conditions experienced throughout the growing period a few of the sets were affected by a rot caused by *Rhizoctonia solani* and *Pythium* spp. These were taken in hand by the Mycologist in good time and no further trouble was experienced. The results shown in Table III are actual weights of ginger obtained per plot and are not corrected for losses due to disease. Each plot was separately harvested, care being taken that as few rhizomes as possible were left in the soil. The rhizomes were carefully washed without delay and weighed as soon as the wash water had drained off.

Table III shows the actual weights of green ginger in lb.

A glance at this table will show the great variation in yields due to the different treatments. The mean yield varies from 117·8 lb. in the Nugegoda untreated plots to 184·8 lb. in the local artificially manured and mulched plots, a variation of 44·7 per cent. on the average yield. The table also brings out clearly the variation in block yields. Block C which has the steepest gradient and hence the greatest erosion, registers the lowest yield, while block A which is most favourably situated shows the highest total yield, the yield variation between the two being nearly 33 per cent. of the general mean.

ANALYSIS OF DATA

The statistical analysis of variance of the data indicates that the yield differences due to variety, manuring and mulching are definitely significant, while those due to lime and the interactions

Photo. Plate II. The harvested ginger *L. S. Bertus*

TABLE III

Yields per plot in lb. of raw ginger

Treatments	Blocks A	B	C	Total	Mean
1. N	150·5	120	83	353·5	117·8
2. N S	151	123	118	392	130·7
3. N L	142·5	100	111	353·5	117·8
4. N L S	191·5	121	97·5	410	136·7
5. G	142	166	106	414	138·0
6. G S	167	170	132	469	156·3
7. G L	142·5	142·5	106	391	130·3
8. G L S	130·5	149·5	128	408	136·0
9. N C	166·5	149	103	418·5	139·5
10. N S C	195	144·5	117·5	457	152·3
11. N L C	180	171	81·5	432·5	144·2
12. N L S C	237·5	184·5	121	543	181·0
13. G C	236	150·5	148	534·5	178·2
14. G S C	182	163·5	154	499·5	166·5
15. G L C	150·5	175·5	100	426·0	142·0
16. G L S C	152·5	202·5	156·5	511·5	170·5
17. N A	169	162·5	102·5	434	144·7
18. N S A	182·5	163	121	466·5	155·5
19. N L A	153·5	140	107	400·5	133·5
20. N L S A	201	189·5	111	501·5	167·2
21. G A	155	153·5	118	426·5	142·2
22. G S A	178·5	206	170	554·5	184·8
23. G L A	155·5	158	147·5	461·0	158·6
24. G L S A	183	195	170	548	182·7
Total	4095·5	3800·5	2910	Grand Total	10·806
				General Mean	150·085

between the different factors concerned with yield, are not significant. The yield results for each of the different treatments are summarised in Tables IV to VIII below and are shown graphically in Plate III. The figures represent the amounts of green ginger.

TABLE IV

Effect of Variety

	lb. per plot	cwt./acre	tons/acre	% of mean
Nugegoda (average of 36 plots)	143·4	119·1	5·95	95·5
Local (average of 36 plots)	156·8	130·2	6·50	104·5
Difference	13·4	11·1	0·56	9·0
Significant difference (P = ·01)	**13·3**	**11·1**	**0·56**	**9·0**

GINGER MANURIAL AND CULTURAL TRIALS

GIRAGAMA

1933 — 1934.

YIELDS IN TONS PER ACRE.

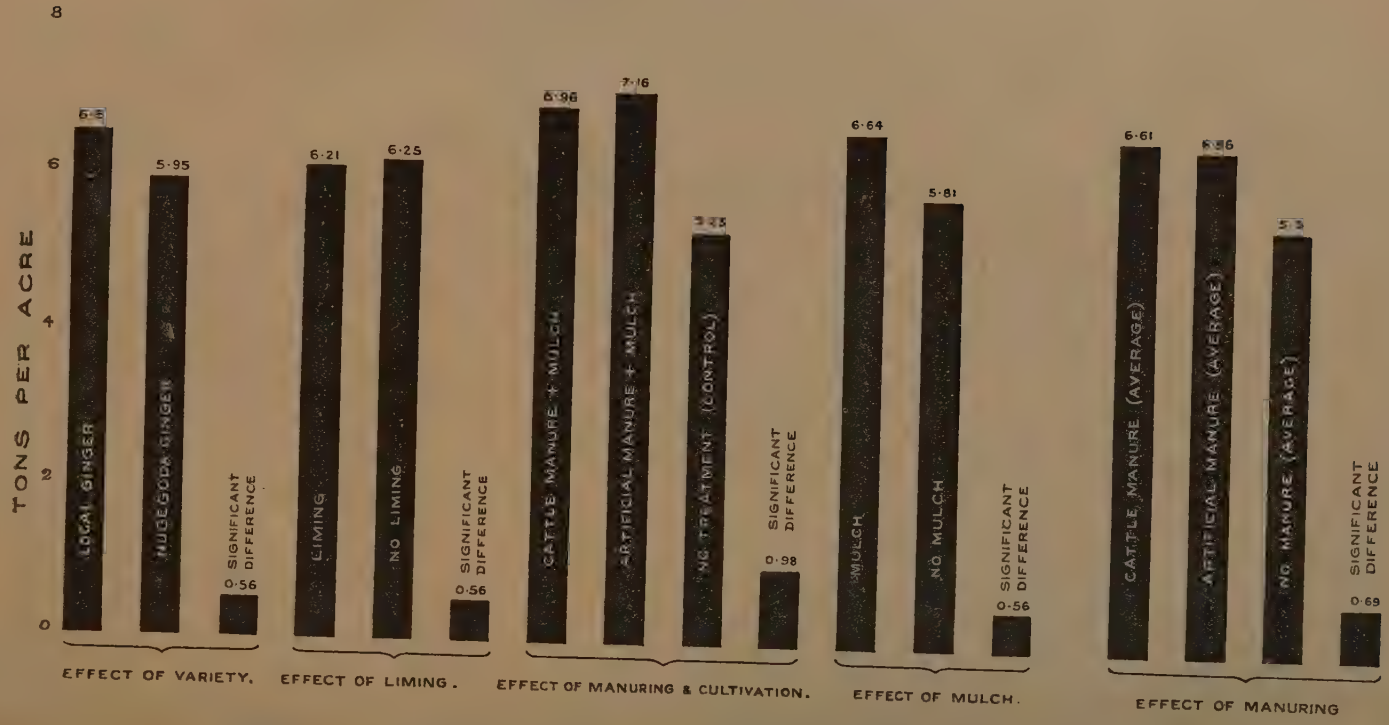

Plate III. The effects of manurial and cultural treatments on yield of ginger

Local ginger is therefore a significantly better yielder than Nugegoda ginger, the probability being 100 to 1 of this being so. An increase of over half a ton per acre or 9 per cent. is obtained under the conditions of the experiment, the general average yield being 6·23 tons per acre.

TABLE V

Effect of Manuring

	lb. per plot	cwt./acre	tons/acre	% of mean
1. No manure (average of 24 plots)	133·0	110·4	5·50	88·6
2. Cattle manure (average of 24 plots)	159·3	132·2	6·61	106·1
3. Artificial manure (average of 24 plots)	158·0	131·2	6·56	105·5
Difference between 2 & 1	26·3	21·8	1·09	17·5
,, ,, 3 & 1	25·0	20·8	1·04	16·7
,, ,, 2 & 3	1·3	1·0	0·05	0·8
Significant difference (P = ·01)	**12·4**	**13·9**	**0·69**	**11·2**

The above table indicates that manuring with cattle manure and artificials at the rates stated produces definitely significant increased yields, the probability being over 100 to 1 that this is actually the result of the treatments. The increases in each case are just over a ton of green ginger per acre or about 17 per cent. of the mean yield. The difference between the average yields from the two types of manuring at the rates applied is wholly insignificant. This result is not unexpected as the cattle manure used at Giragama contained on the average ·33 per cent. potash, equivalent to about 70 lb. per acre, while the artificial mixture contained about 89 lb. per acre of this constituent. On the other hand the organic matter of the cattle manure and its higher nitrogen content (·4 per cent or 83 lb. per acre against 37 lb. in the artificial mixture) would tend to counterbalance any increased yield differences which the higher potash content of the artificial mixture would give.

It would be interesting here to compare the above yield data with those obtained previously at Siyambalagoda. The control plots at Sivambalagoda gave an average yield of 4·53 tons per acre and the complete mixture plots 8·72 tons per acre, against yields of 5·50 and 6·56 tons respectively at Giragama. The higher yields obtained from the completely manured plots last year can almost entirely be attributed to the much larger quantity of fertiliser applied. The rate of application of the

mixed fertiliser was then 15 cwt. per acre against 5 cwt. on this occasion. On the other hand the control plots gave a higher average yield this year. This is mainly due to the Giragama soil having been uncultivated for a long time and being much richer in fertilising constituents than the Siyambalagoda soil, and to a lesser extent to the fact that the control figure in Table V represents the average of all plots without manure including those which had been mulched. The importance of the soil factor in ginger yields is therefore apparent.

Another point of note is the relative accuracies of the two manurial trials. The standard error of the mean treatments at Siyambalagoda was 9·7 per cent. or ·58 tons per acre and the significant difference for a 100 to 1 probability 41·8 per cent. or 2·5 tons At Giragama for comparisons between manurial treatments the standard error was as low as 2·9 per cent. or ·18 tons with a significant difference of 11·2 per cent. or ·69 tons. The accuracy of this experiment is therefore seen to be nearly four times that of the previous one and can be attributed largely to the much greater number of replications involved.

TABLE VI

Effect of Liming

	lb. per plot	cwt./acre	tons/acre	% of mean
Limed plots (average of 36)	149·6	124·2	6·21	99·7
Non-limed plots (average of 36)	150·5	125·0	6·25	100·3
Difference	0·9	0·8	0·04	0·6
Significant difference (P = ·01)	**13·3**	**11·1**	**0·56**	**9·0**

It will be noted from the above table that the differences due to lime are wholly insignificant. Liming would therefore appear to be unnecessary for ginger even when the crop is grown on acid soils. On examining the data of the limed plots in greater detail, it is noted that whilst the Nugegoda variety shows an increase of 5·5 cwt. per acre as a result of liming, the local variety registers a decrease of 7·1 cwt. These differences are not however significant.

TABLE VII

Effect of Mulching

	lb. per plot	cwt./acre	tons/acre	% of mean
Mulched plots (average of 36)	160·0	132·8	6·64	106·6
Non-mulched plots (average of 36)	140·1	116·3	5·81	93·4
Difference	19·9	16·5	0·83	12·2
Significant difference (P = ·01)	**13·3**	**11·1**	**0·56**	**9·0**

A mulch of straw is seen to be definitely beneficial for ginger, an increase of 16·5 cwt. per acre or 12·2 per cent. of the mean yield being obtained by this agricultural treatment. The reasons for the increase are twofold. There is in the first instance the physical effects of the mulch on moisture conservation and check to weed growth. The season having been a very wet one, the effect of the mulch on water conservation was of little importance. A more important reason for the increase is probably connected with the chemical and biological effects of decomposed straw. Owing to optimum moisture conditions for decomposition, the straw had broken down almost completely in the short period of about two months and the mulched plots had doubtless derived the fullest benefits therefrom. Paddy straw contains about 35 per cent. of organic matter and 1·5 per cent. of potash. At the rates applied, the amounts of organic matter contributed by the decomposed straw mulch would be approximately 1,370 lb. and of potash about 58·5 lb. per acre. This amount of potash alone would account for an appreciable increase in yield. An experiment to determine which of the two sets of factors concerned contributes more to increased yield has been laid out at the School Farm, Peradeniya this season.

In Table VIII below are shown the effects of manuring and cultivation. As liming has been found to have had no influence on yields, the yields of the limed plots are reckoned along with those of the non-treated or mulched plots as the case may be.

TABLE VIII

Effect of Manuring and Mulching

	lb. per plot	cwt./ acre	tons/ acre	% of mean
1. No treatment (average of 12 plots)	126·0	104·6	5·23	73·4
2. Cattle manure alone (average of 12 plots)	151·0	125·5	6·28	100·0
3. Artificial manure alone (average of 12 plots)	143·5	119·2	5·96	95·6
4. Cattle manure + mulch (average of 12 plots)	167·6	139·2	6·96	111·7
5. Artificial manure + mulch (average of 12 plots)	172·5	143·2	7·16	114·9
Difference between 2 & 1	25·0	20·9	1·04	16·6
,, ,, 3 & 1	17·5	14·6	0·73	11·8
,, ,, 4 & 1	41·6	34·6	1·73	38·3
,, ,, 5 & 1	46·5	38·6	1·93	41·5
,, ,, 4 & 5	4·9	4·0	0·20	3·2
Significant difference (P = ·01)	**23·7**	**19·7**	**0·98**	**15·8**

A glance at this table will show that by artificial manuring and mulching an increase of 38·6 cwt. or nearly 2 tons of green ginger per acre was obtained over non-manured and non-mulched ginger. Cattle manure and mulching at the rates applied gave an increase of about 34·6 cwt. The small difference between the two combined treatments is not at all significant. Cattle manure alone gave an increase of about 21 cwt. and artificials alone about 14·5 cwt. per acre.

Though it would appear from the table that the effect of mulching is greater with artificials than with cattle manure, the detailed statistical analysis indicates that there is no significant differential response of mulching to manurial treatments. The only correct conclusion that could be drawn from the data is that mulching and manuring, singly and conjointly produce significant increased yields. There would however appear to be some indication that when cattle manure is used for manuring ginger, mulching is not so necessary as when artificials alone are applied.

ECONOMICS OF MANURING AND CULTIVATION

The data shown in Tables VII and VIII may be used to determine the relative economic returns from the various types of manuring and cultivation. In the balance sheet shown in tabular form below the cost of straw is reckoned at 50 cents a cwt., a low grade material being sufficient for the purpose. The cattle manure is valued at Rs. 2/- per cartload or Rs. 4/- per ton of two cartloads. The price of ginger is reckoned at Rs. 2/- per cwt.

It will be seen from the above table that the application of cattle manure and artificals along with straw will be productive of increased profits in the neighbourhood of Rs. 20/- per acre, if raw ginger is reckoned at Rs. 2/- per cwt. Where cattle or artificial manure alone is used, no increased profits are obtained at this price of ginger. The reverse appears to be the case. The nett returns shown in the table will however vary to some extent.

From the results of this experiment, and with ginger at a price of Rs. 2/- per cwt, it may be concluded that the manuring of ginger grown on virgin soils with artificials or cattle manure alone, will not be conducive to increased profits. Accompanied with mulching, however, increased profits can be secured even on these soils. On poor eroded soils, on the other hand, as at Sivambalagoda, manuring will appear to be definitely beneficial. Mulching alone has given an increased profit of about Rs. 20/- per acre even on fertile soil.

TABLE IX

		Increase over control : cwt. raw ginger per acre	Amount of manure or straw per acre	Cost of manure including freight	Cost of straw	Cost of application	Total cost of treatment	Value of ginger	Difference between last two columns
1.	Cattle manure + mulch	34·6	9·2 tons	Rs. 36·80	Rs. 17·50	Rs. 5·00	Rs. 59·30	Rs. 69·20	+ Rs. 19·90
2.	Artificial manure + mulch	38·6	5 cwt.	,, 34·50	,, 17·50	,, 5·00	,, 57·00	,, 77·20	+ ,, 20·20
3.	Cattle manure alone	20·9	9·2 tons	,, 36·80	—	,, 3·00	,, 39·80	,, 40·80	+ ,, 1·00
4.	Artificial manure alone	14·6	5 cwt.	,, 34·50	—	,, 3·00	,, 37·50	,, 29·20	− ,, 8·30
5	Mulching alone	19·9	35 cwt.	—	,, 17·50	,, 3·00	,, 20·50	,, 39·80	+ ,, 19·30

CONCLUSIONS

It is recommended therefore that in all areas where ginger is grown, straw mulching be established as a definite practice, as even at a price of Rs. 1/50 per cwt. of raw ginger an increased profit can be assured. When prices are about Rs. 2/- per cwt, mulching and manuring with artificials are recommended. A mixed fertiliser is advisable, but the application of about 200 lb. per acre of sulphate or muriate of potash alone will be beneficial if accompanied by mulching. When artificial manures are expensive the fullest use should be made of cattle manure if it is available.

SEED RATE EXPERIMENT

In order to determine to what extent the seed rate affected yields of ginger, a simple experiment was laid out in the form of a Latin Square. The ginger was intended to be planted out at the rates of one ton, half ton and one-third ton per acre of seed ginger, the local variety being used for the purpose; but the actual quantities applied worked out at one ton, ·56 tons and ·33 tons respectively. The size of each plot was 80 square feet, the number of holes per plot being 50. The holes were heavily manured with cattle manure as in the local method of planting. The yields per plot are shown in the plan below to the nearest lb. of green ginger.

	Columns			Total	Mean
Rows	B 30	A 43	C 28	101	33·7
	C 27	B 34	A 47	108	36·0
	A 45	C 26	B 31	102	34·0
Total	102	103	106	311	
Mean	34·0	34·3	35·3	General Mean	34·6

The treatment totals and means are as follows:

	Seed rate	Total lb.	lb. per plot
A	1 ton/acre	135	45·0
B	·56 ,,	95	31·7
C	·33 ,,	81	27·0

Photo. *L. S. Bertus*

Plate IV. Typical bunched ginger obtained in the local planting method

The statistical analysis of the data shows that the effect of treatment is clearly significant. The results are expressed in cwt. per acre and as multiples of the seed rate in Table X.

TABLE X

Seed rate	lb. per plot	Cwt./acre	Tons/acre	Fold
1 ton per acre	45	219	10·95	10·9
·56 ,, ,,	31·7	154	7·7	13·8
·33 ,, ,,	27	131·3	6·56	19·7

It will be observed that the seed rate of one ton per acre has given the highest yield return and the seed rate of ·33 tons the lowest yield. Expressed in terms of the seed rate the yields however show an increase with decreasing seed rate. Thus the yield return from one ton per acre is about 11 fold, while that from ·33 tons per acre is nearly 20 fold. The nett returns are however greater with the higher seed rates and it would appear therefore that from the practical standpoint the higher seed rates are preferable. A further investigation is however necessary to confirm these observations and experiments to this end have been started this season. One further point about this seed rate trial needs mention. The yields obtained, compared with those of the manurial trials, are appreciably higher. The high yields can be attributed to the very favourable situation of the plots and their good soil condition and are yet another instance of the effect of soil conditions on yield of ginger.

EXPERIMENT TO DETERMINE THE BEST METHOD OF PLANTING SEED GINGER FOR CURING PURPOSES

Another simple experiment to determine whether the planting of seed ginger in large hands (approximately 3 inches by 5 inches) as practised locally, is preferable to planting in small pieces as in Jamaica, from the standpoint of both yield and type of rhizome, was carried out in four randomised blocks each containing a pair of plots. Selected local ginger was planted in holes manured with cattle manure at a distance apart of 15 in. by 15 in., there being 60 holes to each plot. The plots and blocks were separated from one another by narrow drains. The seed rate worked out at about 2,722 lb. per acre.

The results are shown in Table XI below and typical hands from the two sets of plots shown in Plates IV and V for comparison.

TABLE XI

Blocks	Local Method lb. per plot	Jamaica Method lb. per plot
1.	46·5	44·5
2.	43·5	42·5
3	37·5	34·5
4	32·0	29·0
Total	159·5	150·5
Mean	39·9	37·6
Difference	2·3	
Significant difference (P = ·01)	**8·1**	

A statistical examination of the data shows that the average yield difference is definitely not significant for a probability of 100 to 1, though it amounts to about 10 cwt. per acre. The types of hands obtained appear however to be different. In the case of the Ceylon method of planting, the hands from a single set are small in size and, though numerous, bunched together. The 'fingers' too are very numerous. These characteristics are disadvantageous for curing. The hands from the small sets as in the Jamaica method appear on the other hand to be larger in size, are much less bunched together and separate quite easily. They are decidedly superior to the bunched hands for curing. It is likely however that even better ginger for curing purposes might be obtained by planting small sets with not more than two 'eyes' to a set, in holes at closer planting distances than those adopted in these trials. The point is being investigated by the Economic Botanist this season.

SUMMARY

Manurial, varietal, and cultural trials carried out with ginger at Giragama, the centre of a ginger growing area, during 1933, have indicated that under the soil and climatic conditions of the district:

(1) The local variety is a significantly better yielder than the Nugegoda variety (a type of degenerated Cochin ginger mixed with Calicut ginger).

(2) Manuring with artificials at the rate of 5 cwt. per acre is equivalent to manuring with cattle manure at 9·2 tons per acre. Both types of manuring give significantly higher yields than non-manured ginger.

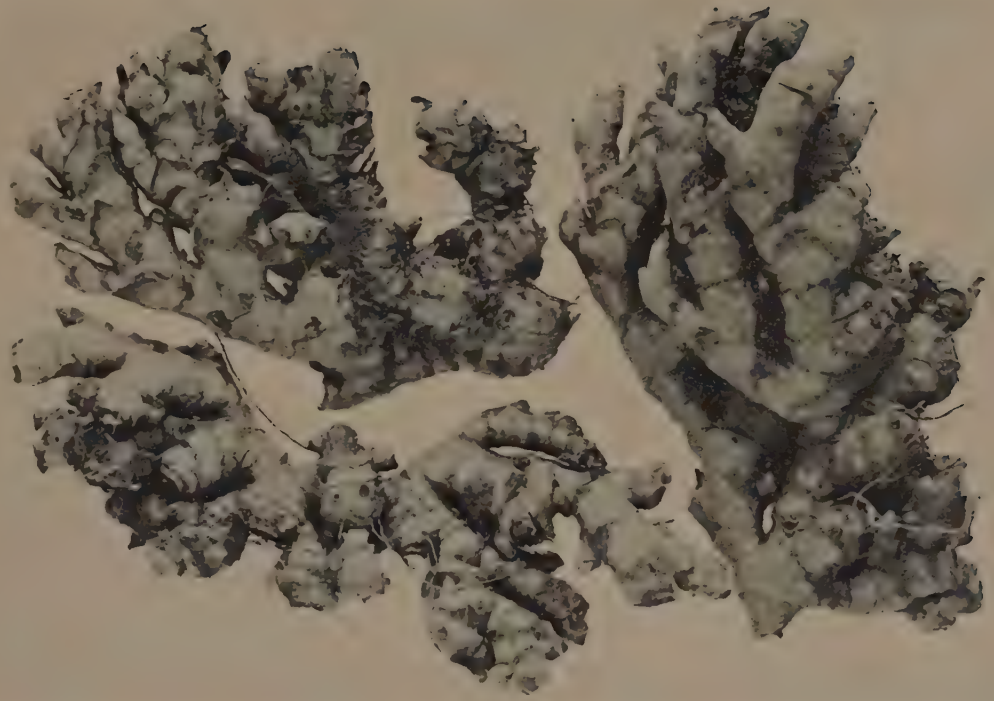

Photo. *L. S. Bertus*

Plate V. Typical hands obtained by planting ginger in small sets

(3) A straw mulch produces a significant increase in yield.

(4) Liming is no advantage from the standpoint of yield.

(5) With raw ginger at Rs. 2/- per cwt., an increased profit of about Rs. 20/- per acre can be obtained by manuring and mulching or by mulching alone.

(6) Average yields of ginger vary appreciably with the soil type.

(7) The optimum seed rate for ginger, so far as these trials show, is about a ton per acre. The proportional yield increase is however greater with decreasing seed rate.

(8) If ginger curing is the object in view, the planting of ginger in small sets would appear to be preferable to planting in large hands as is done locally.

ACKNOWLEDGMENTS

Acknowledgment is made to Mr. W. Molegode, Senior Agricultural Instructor, Katugastota for the great care and attention with which he carried out the field work connected with these trials. Thanks are also due to Mr. L. S. Bertus for having taken the photographs accompanying the paper, to Mr. A. Geo. Alwis for having drawn Plate III, and to Mr. C. Canagaratnam, Agricultural Instructor, Headquarters for having assisted in the weighing of the ginger at harvesting.

THE AVOCADO PEAR*

THE Avocado Pear is a comparatively recent introduction to horticulture although it has been cultivated in Mexico and Central America from very early times. In these countries the fruit is cultivated around dwellings, no large plantations exist and very little care has been taken with its cultivation. During the last thirty years or so, horticulturists in California and Florida have devoted attention to its cultivation and the vegetative propagation of superior varieties. In these two States the cultivation of the Avocado has become of commercial importance. It is also cultivated largely in the West Indies and Hawaii.

The commercial aspect of Avocado culture has been especially emphasised since 1910 when explorers from the United States of America were sent to Mexico and Guatemala to obtain the best varieties cultivated in those regions. The California Avocado Association, which was organised in 1915, has influenced the development of the industry and its committee has rendered valuable service by the registration and classification of varieties. The Year Book of this Association for 1931 contains a list of 400 varieties including names of Avocados published in the West Indies and Hawaii.

A co-operative marketing agency, founded by the Calavo growers of California, in 1924, assists with the marketing of the fruit, and a similar organisation exists in Hawaii, shipping the fruits to American Markets.

The Avocado is now cultivated in most tropical and sub-tropical countries although it has not yet become as popular elsewhere as it is in America.

The date of the introduction of the Avocado into Malaya is uncertain but Ridley mentions that trees were fruiting in Singapore in 1902. The Avocado was also being cultivated at the Government Experimental Plantation, Kuala Lumpur in 1908. A few of these trees fruited in 1913 and, early in 1914, the present writer advocated extending the cultivation of the fruit. Since that date the Avocado has been grown on a small scale in different parts of the Peninsula and has fruited well both in the plains and at the "Gap" 2,800 feet above sea level. During the last decade, seedlings have been distributed by the Department of Agriculture; in spite of this fact, the fruit is not as widely known, even among Europeans, as it deserves to be. This is probably due to the fact that a taste for the fruit has to be acquired, in consequence of which it is rarely seen in the local markets.

BOTANICAL

The Avocado Pear belongs to the Natural Order *Lauraceae* and is therefore related to the Cinnamon. The varieties under cultivation are of two species, viz. *Persea gratissima*, Guertn (syn. *P. americana*, Mill.) and *P. drymifolia*, Cham. and Schlecht (syn. *P. americana* var. *drymifolia*, Mez.) The former species include the West Indian and Guatemalan types or races and the latter the Mexican types.

* J. Lambourne in *The Malayan Agricultural Journal*, Vol. XXII, No. 3, March, 1934.

It is a tree of medium size, attaining a height of 20 to 30 feet under cultivation, but in Central America it is recorded that old trees reach a height of 60 feet.

The tree may be either erect, compact, or spreading in habit. The bark of the trunk and older parts of the branches are grey in colour while the tips are smooth and green. The leaves are alternate, crowded near the ends of the branches and vary in shape from lanceolate to ovate or even obovate with blunt to acuminate tips. The blades of the leaves vary from 3 to 4 inches to as much as a foot in length, light to dark-green in colour, smooth and shining above and glaucous beneath. The flowers are small, yellowish-green in colour, complete with both stamens and pistils, and they are borne in racemes near the ends of the branches.

Stout's investigations on the Avocado have enabled him to classify varieties into two groups (1) those (Group A) in which the flowers function as pistilates or females in the forenoon and staminates in the afternoon and those (Group B) which function as males in the forenoon and females in the afternoon. The flowers open synchronously in sets and there are normally two periods of opening. In Group A the first period of opening takes place in the forenoon when the stigmas are receptive. These flowers close at about midday and open again for the shedding of pollen in the afternoon of the following day. In Group B the flowers open for the first or female phase in the afternoon, close in the evening, opening again for shedding pollen on the following morning or on the morning of the third day. There is a certain amount of overlapping as regards opening and closing of flowers, especially under unfavourable weather conditions when the first and second openings of the flowers are often delayed. Some varieties have been found to produce excellent crops of fruits in the absence of trees of another group, but despite these observed instances in which trees are not dependent upon cross-pollination, Stout considers that interplanting of reciprocating varieties is normally advisable to ensure that proper pollination takes place which is essential to the production of fruit.

VARIETIES

The varieties of both species of Avocado are closely alike in many respects; the differences between the different races are briefly as follows:

1. Leaves anise-scented, skin of fruit thin and membranous (rarely more than 1/32 inch thick) *Persea drymifolia*. The Mexican race.

2. Leaves not anise-scented, skin of fruit thicker (from 1/32 to ¼ inch in thickness) *Persea gratissima*:

(a) Fruit ripe in summer, skin usually not more than 1/16 inch thick, leathery in texture—West Indian Race.

(b) Fruit ripening in winter and spring, skin 1/16 to ¼ inch thick, woody in texture—Guatemalan Race.

The Mexican race is a native of the Mexican highlands and will therefore withstand cold conditions.

The West Indian race has been developed in the tropical lowlands of Guatemala, while the Guatemalan race is a product of the highlands, but there are intermediate forms.

Other distinguishing characters are that the flower of *P. drymifolia* is more pubescent and the underside of the leaf more glabrous than that of *P. gratissima*. The fruits of both species vary in size but those of *P. drymifolia* are usually smaller than those of *P. gratissima*. They vary in size from a few ounces to three pounds; in shape from round to oval and pear-shaped, and in colour from green to purplish-black. The fruit is a drupe having a single large seed, often 2 inches in diameter, in the centre. The edible portion of the fruit is between the skin and the seed, and when ripe is of the consistency of butter, cream coloured to green near the skin, of a nutty flavour and contains a large percentage of fat.

The varieties cultivated in Malaya vary considerably in size, shape, and also colour of the fruit, but the majority belong to the West Indian race. The Mexican type is little known, but a few seedling trees are growing at the Central Experiment Station, Serdang, although they have not yet fruited. In Malaya, the West Indian varieties are suitable for cultivation from sea level up to an elevation of about 3,000 feet. The Guatemalan varieties are said to withstand both cold and heat, also a dry climate, while the Mexican varieties are said to withstand a few degrees of frost. These two races may thrive at higher elevations in this country.

In selecting varieties for cultivation, preference should be given to those with fruits of medium size, say 12 to 16 ounces. The fruit should be of good flavour, the skin tough, leathery and of moderate thickness, so that they will withstand transport for some distance. The seeds should be small and not loose in the cavity otherwise the flesh may be injured in transit.

PROPAGATION

Propagation locally has been by seed, but the disadvantage of this method is that the offspring cannot be relied upon to come true to the parent type; the Avocado is therefore usually propagated by budding or grafting.

Attempts have been made to propagate the Avocado by marcottage but so far without success, although it is reported that, after numerous failures, well-rooted plants have been obtained by this method in the Philippines.

By planting seedlings in beds and laying them down for propagation by the etiolated shoot method, rooted shoots have been obtained, but so far the difficulty in obtaining authentic planting material has made this method impracticable. A stock of budded material is, however, being raised by this Department and will be available in the near future when budded plants of known origin have been established by the etiolation method may prove useful for rapidly increasing supplies of reliable planting material.

The most common method of propagation is by budding and grafting, and the best stocks to use for this purpose in Malaya are seedlings of our local varieties. In California, the Guatemalan race has been budded on to stocks of the Mexican race with the object of giving hardiness to the former, but in the even climate of the plains of Malaya hardiness is a point of little if any importance.

Raising Stocks.—The seeds should be planted as soon as possible after removal from the fruit. They should be planted pointed end upwards in loose sandy soil, in boxes or seed beds and after germination the seedlings should be transplanted into large bamboo pots or into nursery beds at about 18 inches apart. Germination takes place in a short time and seedlings are ready to bud in six to eight months, when the stems will be about one half inch in diameter. It is essential that seedlings to be used as stocks should be maintained in vigorous growth.

Budding Methods.—Several methods of budding Avocados are recommended and have been successful in other countries.

It should be borne in mind, however, that skill and patience are required, and above all a very sharp budding knife. For the benefit of those who do not understand the various methods of budding, they are described briefly as follows:

The 'inverted T' method is performed by making a 'T' shaped incision in the bark of the stock an inch or two from the ground with the blade of a sharp knife. Budwood is then procured from a shoot of recent growth not soft enough to snap when bent but beginning to mature. The buds should be plump but not bursting into growth. The knife should then be inserted about an inch below the bud and drawn upwards and inwards beneath the bud, bringing it out about the same distance above the bud. A shield-shaped piece of bark with a section of wood attached is then obtained. The section of wood should be carefully removed and the bud attached to the piece of bark inserted into the incision in the stock. The bud is then bound firmly in place with raffia or a thin strip of waxed cloth, taking care not to cover the bud completely. In about three weeks from the time of budding the tying material should be removed and if, on examination, the bud is found to be green it should be retied but not tightly, and at the same time the apex of the stock should be pinched out. The bud should be examined again at the end of six weeks and if it is still alive the wrapping may be removed. At the same time the stock may be cut back still further, but some leaves should be left. The stock should not be cut back completely until the bud shoot is about 2 feet in length. When cutting back the stock, a neat cut should be made close to the union between budshoot and scion and the wound should be covered with some protective material such as grafting wax.

Other methods of budding recommended differ only in the shape of the incision in the stock. The Forkert method, a modified form of rectangular patch budding, has been used successfully in Java with buds from non-petioled ripe budwood. The method consists in making three incisions in the stock, two parallel downwards and one across the top, forming three sides of a rectangle. The bark is then raised carefully, gripped between the blade of the knife and the thumb and stripped downwards. Three quarters of the flap of bark is then cut away. A piece of bark of the same size and shape as the incision in the stock containing a bud is then inserted and tied into place. The subsequent procedure is the same as for the inverted "T" method.

Grafting.—In Florida the Avocado has been propagated by grafting the tips of young shoots on to the shoots of young seedlings by a modified method of side-grafting. The operation is performed as follows: The

seeds are germinated in boxes and, when the young shoots are 5 to 6 inches in length, the seedlings are taken from the box and laid on a bench. A cut one inch long is made in the side of the shoot just above the seed and a thin section is removed. The scion is taken from the tip of a small branchlet not fully mature and about one inch long with two axillary buds in addition to the terminal one. The scion is then tapered on one side to fit the cut on the stock and is bound into place. The plant is afterwards potted, placed under partial shade and carefully watered from day to day. After union is effected the top of the seedling is removed and the scion allowed to grow.

Cleft Grafting.—Cleft grafting is used on young stocks and in top working older trees. For grafting on to young stocks the scion should be a partially mature shoot, greenish to light brown in colour and about 4 to 5 inches long. This should be tapered at the lower end and inserted in a cleft in the top of a stock of the same colour and size as the scion.

Top Grafting.—This method is used in cases where a tree has proved to be unfruitful or is of an inferior variety. The trunk is cut back with a saw to within three feet of the ground. The trunk is then split, a saw being used to cut down for several inches when a soft wood wedge is inserted and driven in until the trunk commences to split; the edges of the cleft are then smoothed with a knife. Scions of mature growth are then cut and tapered to fit the cleft, one on each side of the trunk, so that the cambiums of both stock and scion are in contact. The wedge is then lifted sufficiently to allow enough pressure from the cleft in the stock to hold the scion in place, after which the wedge is cut off flush with the top of the stock. The cleft and sides of the stock are then covered with grafting wax to prevent the entrance of water. To prevent sun-scorch the top of the stock and the scion is covered with a tough paper bag, holes being made to allow new growth from the scion to elongate. Another method is to place a paper collar round the top of the stock and fill it with sand, holes being made in the base to allow drainage of rain water. The sand should be placed round the outside of the scion as well as at the top of the stock. These paper coverings should not be removed until the scion is large enough to provide shade. A certain number of shoots from the stock may be allowed to grow to maintain circulation of sap which assists healing. They should be eliminated as soon as the scion and stock have properly united.

Another method of top working old trees is to cut back a certain number of branches leaving one or two as "lungs" to maintain the circulation of sap The young shoots which sprout from the cut branches, should be limited to two or three; when large enough, they are budded in the same manner as seedling stocks.

SOILS AND CULTIVATION

Soils.—The Avocado is said to thrive on a wide range of soils in South America. It grows excellently on both sandy soils in Florida and heavy clays in California, but it is essential that the soils should be well drained. In Malaya it has been grown successfully on both quartzite hill and quartzite valley soils, also in the granite soils of the hills.

Planting.—The distance at which to plant will depend upon whether the soil is particularly fertile or rather poor, also on whether the tree is a seedling or has been propagated vegetatively by budding or grafting. Planting distances recommended are 20 ft. × 20 ft. which allows 108 trees per acre to 26 ft. × 26 ft. or 64 trees per acre. On light sandy soils or with budded plants 20 ft. × 20 ft. is usually sufficient, but seedlings on rich soil may be given the wider spacing.

When planting it is advisable to make large holes, and these should be filled with good top soil and cattle manure or garden refuse. Usually holes 2 ft. × 2 ft. × 2 ft. should be dug and when filling them the soil should be made quite firm.

The Avocado is rather sensitive to disturbance of the roots: plants should therefore be raised in bamboo pots, so that they can be transplanted with the roots intact. If raised in nursery beds the plants should be prepared for transplanting by balling a week or two before this operation takes place. Should the roots be at all disturbed the foliage should be reduced or evaporation will be too rapid and the plants will receive a severe check.

The best time to plant is during the rainy seasons of the year; even at this time a good watering should be given to settle the soil round the roots and the plants shaded until they are established.

After-cultivation consists in keeping the soil round the plants free from weeds and, as the trees develop, the area weeded should be extended. A mulch of weeds and cattle manure is beneficial to the growth of the plant. The Avocado requires good cultivation and manuring to give the best results. Cattle manure, if obtainable, is best for general purposes. The growing of leguminous green crops and turning them into soil periodically will help considerably towards keeping the soil fertile. In addition, fertilizers are recommended in the form of bonemeal, and cotton seed or groundnut cake at the rate of 4 or 5 lb. per tree added to the soil after the trees have borne fruit; and again after the fruit is set. Little is known about the manuring of the Avocado in Malaya, but in addition to cattle manure a mixture of basic slag, calcium cyanamide and sulphate of potash in the proportion by weight of 3 : 1 : 1 may be applied twice a year round the trees at the rate of from 1 to 4 lb. per tree according to age. If the trees appear to be growing vigorously, the calcium cyanamide may be omitted.

Pruning.—Very little pruning is necessary beyond that which is essential to keep the tree in shape, and the cutting out of dead or diseased branches.

PESTS AND DISEASES

In Malaya the Avocado Pear has so far been remarkably free from pests and diseases. In America, thrips, *Heliothrips rubrocinctus* and *H. haemorrhoidalis* have caused damage to the foliage, but spraying with nicotine solution has been an effective control. The red spider, *Tetranychus mytilaspidis* has also done damage but lime sulphur mixture has been used successfully in combating this pest. Attacks by scale insects are also reported from America.

A root disease, *Sphaerostilbi repens*, has caused the death of several trees at the Central Experiment Station, Serdang, and a certain amount of dieback of branches has been noticed.

THE CROP

The Avocado tree, when raised from seed, commences to bear fruit in about the fifth or sixth year from planting, but budded trees are reported to bear fruit much earlier, in some cases, three years after planting. Seedlings planted at the Central Experiment Station, Serdang, in October, 1927 fruited in August and September, 1932. Others planted in April, 1928 fruited in August and September, 1933, while one tree planted in September, 1929 fruited in September, 1933.

Mature trees will bear from a few fruits up to several hundred. Large trees, in their country of origin, are said to bear from 1,000 to 3,000 fruits from 6 to 18 ounces each in weight. Trees bearing larger fruits bear less, the average, however, is said to be 200 to 300 fruits of 12 to 14 ounces each in weight.

Seedling trees vary considerably in their capacity for bearing fruit, they are also said to be irregular in bearing, for a tree bearing a good crop one year may not fruit the next. This is the case at the Central Experiment Station, Serdang, where only about 50 per cent. of the trees have borne fruit in 1933 and of these about half have borne an average crop, others a few fruits only. The fruits from different trees varied in size from 3 to 4 ounces up to 14 or 16 ounces; in colour from green to purple; the skins of the fruits of some trees were quite smooth while others were rough. None of the trees bore very large fruits compared with varieties under cultivation in the countries of origin, California and Florida, where it is reported that varieties bear fruits up to 3 lb. in weight.

The Avocado Pear at Serdang commences to flower about the middle of January and the fruits ripen in August and September. There is some difficulty in judging when some varieties are ripe, especially those with green skins. With the purple varieties there is not so much difficulty, for the fruits are green until they commence to ripen, when the colour gradually changes to a purple tinge. The fruits should be picked before they commence to soften, more especially if they are to be transported some distance to a market. Fruits picked when too under-ripe may shrivel slightly, but if picked when nearing maturity they may be stored until they soften.

METHODS OF PREPARATION FOR FOOD

In its country of origin the Avocado Pear forms an important article of diet to the population who use it daily throughout more than half the year. An Avocado and a few small corn cakes made from coarsely ground maize is considered, by the Indians of Guatemala, to constitute a good meal. The fruit is broken in half and the pulp, sprinkled with salt, is scooped out of the skin either with the fingers or a piece of corn cake. Among the Guatemalans of European blood, the pulp of the Avocado is usually added to meat soups at the time of serving and the flavour imparted is said to be exceedingly pleasant. Another usual practice is to serve a salad composed of thoroughly mashed Avocado pulp, vinegar, salt, pepper and finely chopped onions. This is said to be a popular and very tasty dish though not especially attractive in appearance.

In the United States of America, where the fruit is increasing in popularity, the pulp is used as a salad either alone or mixed with lettuce leaves, onions or other vegetables. Sliced or mashed it can be made into sandwiches with bread or cracker biscuits. It is excellent as a salad, either with cold meat or with bread and butter, when mashed and mixed with pepper, salt, and vinegar. Mashed with onions and lime juice it constitutes a favourite dish in Cuba. In Brazil it is looked upon more as a dessert fruit and is also made into ice-cream. The pulp of the fruit, mixed with a little sugar and sherry, has a pleasant nutty flavour and in this way can be used as a dessert.

FOOD VALUE

The flesh of the Avocado is a nourishing article of food containing a high percentage of mineral matter, protein and fat. Its chief value as a food is its high fat content, the digestibility of which has been found by experiment to be equal to that of butter fat or of beef fat.

The calorific energy producing value of 28 varieties of Avocado examined at the University of California represents 1,000 calories for one pound of flesh. The maximum and minimum were 1,325 and 597 respectively. The maximum corresponds to 75 per cent. of the calorific value of cereals and is nearly twice that of lean meat.

The following table from Popeno's Manual of Tropical and Sub-Tropical Fruits represents the work of Jaffa of the University of California on the food value of the Avocado:

Variety	Water per cent.	Protein per cent.	Fat per cent.	Carbo-hydrates per cent.	Ash per cent.
Trap (West Indian)	78·66	1·61	9·80	9·08	0·85
Sharpless (Guatemalan)	71·21	1·70	20·54	5·43	1·12
Puebla (Mexican)	63·32	1·80	26·68	6·64	1·56
Fuerte (Hybrid)	69·86	1·25	29·14	7·40	1·35

Recent investigations by Le Roy Weatherley and Eugene W. Waterman of the University of California using Albino rats as indicators, has demonstrated the presence of Vitamin "B" in the flesh of the fruit. The flesh or pulp was compared with Flesschmanns dry yeast standard and was found to have approximately one-twelfth the value of dried yeast. The authors comment as follows: "From these investigations it is apparent that the Avocado ranks high as a source of Vitamin "B". If what is known as Vitamin "B" is in reality two vitamin factors one antineuritic and one growth promoting, as recent investigations seem to indicate, it is evident that the Avocado contains both factors since it prevents paralytic symptoms".

SUMMARY

1. The distribution, botanical and distinguishing features of the different races of Avocado are discussed.
2. The different methods of propagation of the Avocado are given together with notes on its cultivation.
3. The methods of preparation, food value, and vitamin value of the Avocado are given.

THE GRASSHOPPER CAMPAIGN IN MANITOBA IN 1932*

DURING the summer of 1932 Manitoba experienced an extensive and severe outbreak of grasshoppers. This outbreak was not unexpected, since in 1931 grasshoppers had done considerable damage and had deposited many eggs throughout a wide territory. The last previous outbreak in this province occurred during the years 1919, 1920 and 1921 with smaller, minor, scattered infested areas appearing until 1924. The experience gained in this former period proved to be of great value during the outbreak of the summer of 1932.

Three species of grasshoppers occurred in outbreak form. In the eastern part of the infested area the clear-winged grasshopper (*Camnula pellucida* Scudd) was most abundant. Associated with this species was the two-striped grasshopper (*Melanoplus bivittatus* Say) which, although not so abundant, occurred in great numbers in places. In the western part of the infested area the lesser migratory grasshopper (*Melanoplus mexicanus* Saussure) was most destructive. All three species might be found in many fields throughout the territory involved.

Early in the year arrangements were made for the campaign. The provincial government was to supply the ingredients used in the bait. These were bran, sawdust, salt and some form of arsenic. The distribution of the supplies was placed in the hands of the Extension Service, Department of Agriculture, Winnipeg. Each municipality was a unit with the reeve and councillors in charge of local arrangements. Later, mixing stations were established at strategic points in the municipality or at the most central point in that area if one station was deemed sufficient. The local expenses such as the cost of the mixing machine, rentals, cost of hauling, labor etc., were borne by the municipality. Farmers obtained their poisoned bait ready mixed at a mixing station and scattered this bait where required on their farms.

The poisoned bait used commonly during the campaign consisted of the following:

Bran	50 lb.
Sawdust, bulk equal to bran	(approx. $2\frac{1}{2}$ bushels)
Liquid sodium arsenite	2 qts.*
Salt	2 lb.
Water	10 to 12 gallons

* The two quarts of liquid sodium arsenite contained a total of 2 lb. of As_2O_3.

* By Prof. A. V. Mitchener, Department of Entomology, University of Manitoba, Winnipeg, in Sixty-Third Annual Report of the Entomological Society of Ontario, Ontario Department of Agriculture, 1932.

This bait gave excellent results. In future the liquid sodium arsenite will likely contain 8 lb. As_2O_3 per gallon as the handling charges will be less per unit of poison. Some dry sodium arsenite and some Paris green were used effectively during the campaign but only under emergency conditions or where it was impracticable to forward the liquid sodium arsenite. Several car loads of malt sprouts were used to replace bran. They were cheaper and quite as good if not better than bran.

During the summer of 1931 and 1932 experimental work with various killing agents, with and without salt as an attractant, mixed with different carriers was undertaken with grasshoppers in the Department of Entomology. Without going into the detail of these poisoning experiments some of the results may be of interest. In all of these experiments treated Red River water from the taps at the Manitoba Agricultural College was used. The use of salt in the various baits appeared to be of relatively little value. No attractant appeared to be essential to obtain a good kill if the proper insecticide was used. Sodium fluosilicate gave an average kill of 78 per cent. and gave better results without salt than with it. In limited work with calcium arsenate and with sodium fluoride excellent results were obtained with a kill of over 90 per cent. in each case. Calcium fluosilicate appeared to have very little toxic effect upon grasshoppers. The carrier for the poison may be bran, bran and sawdust, malt sprouts and sawdust, brewer's grains or brewer's grains and sawdust to obtain good killing results. Liquid sodium arsenite as given in the bait above seemed in our experiments to be the most effective and economical poison used.

The mixing machines were all made locally and were similar to those largely used in the former outbreak. Each machine had a capacity of two hundred pounds of wet bait at a time. When in operation the drum remained stationary. Four sets of stirring rods extending the length of the drum thoroughly mixed the bait. The outside rod of each set was near the inside surface of the drum. Each mixing machine was run by a gasoline engine. Full details concerning the construction of the mixing machine are contained in Extension Bulletin No. 98, Manitoba Department of Agriculture, Winnipeg. Farmers came to the mixing station and took the required sacks of bait home where it was scattered by hand. No mechanical device has yet been demonstrated which will spread the bait as well as the human hand and arm. Broadcasting the bait thinly as one would scatter seeds gave best results. It is difficult to get the farmers to scatter the bait thinly enough. Heavy applications are wasteful, dangerous to stock and productive of poor results.

The grasshopper outbreak of 1932 was the most extensive ever experienced in Manitoba.

The first bait used was on May 13, but poisoning did not become general before the last week of May. The majority of the mixing stations closed down between July 4 and July 10, although an occasional station mixed bait until the first week of August. Applications of bait made early in the season were much preferred. Much more stress was placed upon timely application of the poisoned bait than ever before. We strongly urged that prepared baits be held on the farms until the proper weather conditions prevailed.

Materials used in the campaign included approximately 4,651 tons of bran, 310 cars of sawdust (70 cu. yds. per car), 204 tons of salt, 76,235 gallons (each gallon containing 4 lb. As_2O_3) liquid sodium arsenite and 14 tons dry sodium arsenite and Paris green. Approximately 16,660 tons of prepared bait were made during the season at a cost of approximately thirty-five cents per one hundred pounds of prepared bait for materials. An additional cost of approximately seventeen and one-half cents per one hundred pounds of prepared bait was incurred in the preparation of the bait. The total cost of the ingredients for the campaign approximated $115,770·25.

Many farmers, particularly, those in the very heavily infested areas, stated that had they not used the poisoned bait they believed that their crops would have been destroyed completely, by grasshoppers. Using the estimate of crop yields for the various crop reporting districts of Manitoba, published by the Manitoba Department of Agriculture for the year 1932 it is estimated that the control campaign undertaken by the provincial government saved the farmers of Manitoba approximately 11,000,000 bushels of wheat, 8,000,000 bushels of oats and 5,000,000 bushels of barley. By virtue of the use of poisoned bait greater yields of forage crops, wild hay, rye, flax, roots, etc. were obtained in the infested areas. Many gardens, including market gardens, were protected either in whole or in part by the use of the bait. In addition the campaign reduced the egg deposits available for hatching in 1933.

The writer wishes to acknowledge the aid of Mr. H. E. Wood, Assistant Director, Extension Service, Department of Agriculture, Winnipeg who was in charge of supplies, for providing the data relating to the cost and distribution of the bait used in the campaign.

Mr. Norman Criddle and Mr. R. H. Painter, Dominion Entomological Laboratory, Treesbank, Manitoba, rendered valuable assistance during the progress of the campaign.

PLANNED ECONOMY AND AGRICULTURE*—*(Contd.)*

CHAPTER III

ECONOMIC PLANNING IN AGRICULTURE

In 1932-33, having entered in the fourth year of the depression, agriculture continued to be in the focus of the trouble. The farmer's problems, all over the world, centred round the basic question of prices, which appeared to the agriculturist under several aspects, all of them equally serious and important.

In the first instance, in common with other producers, the farmer had to contend with the general tendency of prices to decline. The fall in the prices of the principal agricultural products had continued throughout the year 1932, and only in 1933 a slight recovery took place in some of them.

Expressed in percentages of the average prices of the year 1928, the prices of the principal products of farming have moved as follows:

	1928	1933	1932 July-Dec.	1933 Jan.-June
Wheat, Manitoba No. 3, Liverpool ...	100	39·7	36·9	35·8
Rye, Minneapolis No. 2, ...	100	34·5	29·6	36·6
Barley Canadian No. 3, Liverpool ...	100	42·4	37·9	34·5
Oats, La Plata, Liverpool ...	100	38·3	36·4	30·2
Maize, La Plata, Liverpool ...	100	33·9	33·0	31·1
Cotton, Amer. Middling, Liverpool ...	100	34·5	34·9	35·2
Flax, fibre, Riga ZK, London ...	100	33·3	33·7	39·5
Rubber, plant, sheet, New York ...	100	15·3	15·3	16·3
Beef, Argentine, chilled, London ...	100	61·2	60·5	55·4
Mutton, N. Zealand, frozen, London	100	43·1	39·6	43·4
Lamb, N. Zealand, frozen, London	100	46·8	42·0	46·1
Pork, Chicago ...	100	40·0	39·6	37·7
Bacon, Danish London, ...	100	48·4	48·9	52·8
Butter, Danish, London ...	100	46·0	44·4	37·7

As a result of the fall in prices of certain of the most important products including wheat, which have not shared in the slight recovery of 1933, the total value of agricultural production diminished heavily in 1932-33. Thus in Germany, in spite of the market being highly protected, it was estimated that the gross value of agricultural production in 1932-33 was 9 milliards of RM., as compared with 14 milliards RM. in 1928-29. In Canada, the gross agricultural revenue was estimated to have declined from 1·3 milliards of dollars in 1930 to 0·8 milliards in 1931 and to 0·7 milliards in 1932. In the United States the gross farm income was estimated at the following figures, in milliards of dollars; 1923-29, 11 to 12; 1929, 11·92; 1930, 9·41; 1931, 6·91; 1932, 5·14 or under 50 per cent.

* By George Pavlovsky in *International Review of Agriculture* Year XXV, No. 1, January, 1934.

of the amount reached before the depression. These few examples are sufficient to convey a rough idea of the enormous losses suffered by agriculture in the course of the present depression, owing to the fall in the prices of the products of farming.

The effects of the general fall in prices represent, however, only one of the several aspects of the price problem in agriculture.

Had prices declined all-round, in all industries as well as in agriculture, and in manufactured goods as well as in foodstuffs and primary commodities, the purchasing capacity and the whole economic position of the farmers would not have suffered to the extent to which it has actually suffered now. A fundamental aspect of the agricultural price problem, therefore, is that of the disparity between the movements of the prices of farm products, on the one hand, and of industrial products, on the other. The standing grievance of agriculture during the depression—and on many other occasions in the past as well—is that the decline in the prices of agricultural products has been considerably more pronounced than that in other prices, and that farmers, accordingly, have been victimised.

The discrepancy between the price trends has, indeed, been very marked. Unfortunately, the available statistics permit a comparison to be made only for a few countries; but the index numbers given in the table below tend clearly to demonstrate the position of inferiority occupied by agriculture in this respect.

	1913	1931	1932	1933 Jan.-June
Germany:				
Agricultural products ...	100	103·8	91·3	82·8
Agricultural implements ...	100	130·7	116·1	111·4
Finished manufactured goods	100	140·1	117·5	110·2
Wholesale prices, general ...	100	110·9	96·5	91·4

	1926	1931	1932	1933 Jan.-June
Canada:				
Canadian farm products ...	100	56·3	48·3	46·9
Consumers' goods ...	100	80·0	78·8	75·7
Wholesale prices, general ...	100	72·1	67·0	65·3

	1926	1931	1932	1933 Jan.-June
United States:				
Agricultural products ...	100	64·8	48·2	45·7
Non-agricultural commodities	100	73·0	68·4	64·8
Wholesale prices, general ...	100	71·1	64·9	61·5

	1917	1931	1932	1933 Jan.-June
Poland:				
Agricultural products ...	100	59·7	52·0	49·5
Industrial products ...	100	79·4	69·6	63·7
Wholesale prices, general ...	100	70·5	61·6	57·4

	1926	1931	1932	1933 Jan.-June
Yugoslavia:				
Vegetable products ...	100	96·7	67·5	62·5
Animal products ...	100	97·7	56·6	57·4
Industrial products ...	100	80·2	66·2	72·7
Wholesale prices, general ...	100	88·8	65·2	66·8

This discrepancy between the rate of decline in the prices of agricultural products, which the farmer brings to market, on the one hand, and in the prices of commodities he buys, on the other, is very much to his disadvantage; but it is largely due to causes inherent in the nature of the agricultural industry.

Agriculture, indeed, is severely handicapped by its inherent inability rapidly to adapt its production to changes in the conditions of the market. Scattered and essentially individualistic in outlook, farmers cannot easily organise and combine with a view to achieving a certain unity of control over their productive and marketing activities. While in other industries, the keener the competition, the stronger is the tendency towards combination and the regulation of production and sales by organised producers with a view to maintaining the prices of their products, farmers are not in a position by organised effort to reduce and to control competition among themselves. When they possess, as they often do, a considerable political influence in their respective countries, owing to their powerful vote, they may succeed in obtaining from the legislature or the administration some measure or other aimed at relieving their immediate plight. But when, as it frequently happens, these measures are simply palliatives capable only of mitigating the impact of competition, without effectively dealing with the roots of the trouble, they are likely, in the long run, rather to make the position worse than to improve it. While the political organisation of the agricultural interests, though it may be effective in obtaining immediate relief, is seldom capable of solving the economic problems of farming, the difficulties of organising agriculture for business purposes are enormous.

One of the methods, cruel but never failing in its effect, by which, in other industries and trades, competition tends to restore the disturbed equilibrium of supply and demand, is the ruthless elimination of the marginal producers. In agriculture, no elimination of marginal producers, on a scale at all comparable to that which takes place in other industries, is possible. The great bulk of producers consists of small peasant farmers who will go on producing so long as their industry, which for them is not only an occupation, but a traditional mode of life, will supply them with the necessary minimum of food and of housing. Even when the mass of farmers goes actually bankrupt, no Government in a country with a large agricultural population would face their eviction. The Governments and the mortgage banks, in such an emergency, would make some arrangements which would permit the farmers to remain on their farms, either on the basis of some sort of moratorium of farm debts, as has recently been done in several countries of Eastern and Central Europe, or as tenants of their former properties, now legally forfeited to the banks, as in the United States. In both cases, the output even of the marginal producers would not be so completely eliminated as to improve the conditions of the market by reducing supplies: production will generally be continued on more or less its former scale.

The result of all this was that, while, when the depression set in, other industries have immediately started, by combined effort, to adapt supply to demand by reducing their output and exercising a strict control over their sales, agriculture went on producing as before, and in some cases

the ever attempted to increase production, to raise greatly the quantity of products brought to market the losses suffered by the fall in prices.

The influence of the development of industrial production on the net world area sown to the five principal cereals, as the latter, is shown in the table below in which the index numbers of world industrial output are taken from the publications of the Institute for Economic Affairs in Berlin.

Years	Industrial Production	Area sown to principal cereals	
		U.S.S.R. included	Exclusive of U.S.S.R.
1928	100	100	100
1929	106·9	101·0	100·7
1930	93·6	103·8	102·4
1931	83·1	104·0	101·1
1932	76·0	—	100·1

The influence on the relative to the increase of industry, on the one hand, and of agriculture, on the other is indeed striking. It is due partly to the lack of unity of control in farming as compared with the primary and the manufacturing industries, which have been able to combine not only nationally, but sometimes even on an international scale. Partly, it is connected too by the fundamental importance attached in many countries to the keeping of the agricultural population on the land at any cost.

The economic rôle played by barter conventions in maintaining the prices of the products of agricultural industries may be judged from the table below which shows the influence of the price movements of manufactured goods on the one hand, and non-manufactured goods, on the other, in Germany, during the depression.

January	Manufactured goods	Non-manufactured goods
	(1926 = 100)	
1929	104·6	101·9
1930	105·0	90·4
1931	95·2	66·2
1932	84·3	51·2
1933	83·5	45·7

The economy in agriculture, as a non-organised branch of production, is so important for states in the diminishing returns thereof against industries more easily organised and mechanised, can clearly be inferred from these figures.

Among the manufacturing industries the most highly organised are those engaged in the production of machinery and industrial equipment—the metallurgical, metal-working, engineering and electrical industries—and it is to this fact that the relative stability during the depression of the prices of producers' goods has been largely due.

At a time when the national income is diminishing under the influence of the depression, an income of production can escape a proportional reduction in its particular share of the national income, except by using its

power of organisation to exercise upon the wages of the less organised branches. Such agriculture belongs to the unorganised sector of production; it is, therefore, being not only unskilled but also resistant to the industries which use their higher power of organisation to aim to throw on it a part of the burden they should have borne.

The farmer not only does part of the burden by the fall in the prices of his products but also of his increased returns he is called upon to pay relatively higher prices for the products of other industries which he buys for his farm and his household.

This brings in yet another aspect of the agricultural problem, namely the relations existing between the prices of agricultural products and their costs of production.

The relations between prices and costs of production in agriculture were been profoundly disturbed by the war and by its consequences. During the war practically all items of costs have increased considerably, partly owing to the general rise in prices and to measures taken to encourage agricultural production the margin between costs and prices was maintained and even often increased, so that in many countries the war period has been a prosperous time for the farmers. This prosperity which due to war-time conditions and to a series of artificial measures, such as guaranteed prices etc., did not only after the war. Since the middle of 1920-21, the situation changed completely. The prices of agricultural products fell rapidly, while many of the most important items of cost have not been affected by the deflation. Rents remained, increased by the war, were a heavy and stubborn load then. The progress of social legislation which was accelerated during the war and in the course of the political and social upheavals of 1918 and 1919 have imposed upon all branches of production largely increased charges for social services. Agricultural wages which increased considerably during the war and the period of inflation, and which represent probably the largest single item of costs in farming, could not be reduced to an amount which, owing to the progress made in the organisation of agricultural labor on the one hand, and to the existence in many countries since the war of wages boards and other statutory bodies which fixed the wages rates for the farmers to pay, on the other hand, approximated certain changes on mortgages and loans, largely based on transactions concluded during the period of inflation and amounting to nominal large values, and at rates of interests reflecting extreme conditions, also weighed on the farmer very heavily and represented fixed items of costs. Thus, a very large proportion of the agricultural costs has fixed, and only the minor items have, as a rule, been more or less reduced by the deflation.

Accordingly from 1920-21 agriculture, in spite of notable improvements in the price situation has been suffering depressed when other industries had spells of prosperity. When the present depression set in, it found the farmer already struggling for years with the problem of adapting his costs of production to the price level, and it cannot be said that agriculture had practically succeeded in restoring the balance. The index numbers of the movement of prices of agricultural products on the one hand, and of the principal items of production on the other, which are unfortunately available for a few countries only, tend to show

that the necessary equilibrium was still far from being achieved on the eve of the present depression. Thus, in Switzerland, in 1928, the index number of prices of farm products (1914=100) was 151; that of costs of production 172. In Holland, in June 1929, the indices (1910-11 to 1913-14=100) were: agricultural products, 129; wages, 204; all costs, 168. In Sweden, in 1927-28, the index numbers (1908-13=100) were: 143 for agricultural products, 186 for wages and 152 for commodities bought by the farmers. In Germany, in 1928-29 all farm costs stood at 190·5 per cent. of the pre-war figure, while agricultural products reached only 132 per cent.

The fact that, even before the beginning in 1929 of the present crisis, farming was depressed by its inability to balance its costs of production with the prices of its products, is also borne out by the examination of the statistics based upon the results of farm accountancy in various countries. The statistical study of farm accountancy has been carried on by the International Institute of Agriculture for the last few years, and the first results analysed and published in 1931 refer to the agricultural year 1927-28. Thus the materials now available for 16 to 18 European countries, of which about 12 give results which can be accepted as sufficiently representative of the real conditions and tendencies of farming in their respective countries, cover two years immediately preceding the present depression, namely 1927-28 and 1928-29.

It will be seen from the table on page 371, in which figures for ten European countries, very different in every respect, are given, that on the eve of the present depression the average net returns of peasant farms per hectare were negative nearly in every case. As a rule, the average farmer had not been able to make both ends meet and had been working at a loss, which had to be met either by drawing on capital, or by borrowing, or, finally, by lowering the whole standard of life of the farmer and his family, neglecting replacements of stock, etc.

The development of the depression since 1929 made the position more precarious still, because the fall in agricultural prices, especially since 1930, became exceedingly rapid, while the further reduction of costs was very difficult. Both on the farm and in their private households the farmers have often reached the extreme limits of possible economies, and little more could be done in this direction. There remained the fixed charges and the wages bill to fall back upon. In wages, there has been a considerable reduction everywhere. In the United States, the index numbers of agricultural wages calculated by the Bureau of Agricultural Economics (1910-14=100) were as follows: 1929, 170; 1930, 152; 1931, 116; in July 1932 the index was 90. Taxes and interests on debts had often simply to be left unpaid, as a result of which the number of foreclosures and forced sales of farm property increased greatly. In his Letter on the Farm Debt Problem, presented to Congress in March 1933, the Secretary of Agriculture of the United States, after comparing the incomes of farmers with the amounts they have to pay in taxes and debt charges, says that "many farmers even among those who have no debt and therefore no interest to pay, are nevertheless unable to meet their taxes from this year's income, and can pay them, if at all, only by borrowing money for the purpose, or by drawing on other resources. Cases of this kind occur, of

course, even in years when farm prices are favorable by reason of crop failures or other local disasters, but this year it will be true of many farmers even without any special disasters to crops and livestock." The same Letter contains statistical data concerning forced sales for debt and taxes, which, after having, in 1929, reached the lowest figure for some years, have more than doubled in 1932. Indeed, the total number of forced sales of farms in the United States per 1,000 farms were: in 1929, 19·5; in 1930, 20·8; in 1931, 26·1; and in 1932, 41·7.

In 1930-1931, the second year of the present depression, for which the International Institute of Agriculture could ascertain the relations of the prices of certain important agricultural products in a number of countries by means of calculations based on the farm accountancy data at its disposal, the prices in all these cases were below the cost of production. The following table shows the current market prices compared with those which, according to the calculations made, should approximately be sufficient just to meet the costs, without any margin of profit left over.

NET PROFITS OR LOSSES OF PEASANT FARMS

Country	Years	Number of farms		Profits or losses on total farm assets (gold francs per hectare)
Denmark ...	1927-28	573	—	99·77
	1928-29	599	+	47·21
Switzerland ...	1927-28	500	—	233·45
	1928-29	504	—	162
Austria ...	1927-28	397		—
	1928-29	743	—	34·13
Czechoslovakia ...	1927-28	221		—
	1928-29	228	—	25·40
Poland ...	1927-28	804	+	8
	1928-29	855	—	48·67
Latvia ...	1927-28	117	—	16·31
	1928-29	132	—	38·34
Estonia ...	1927-28	250	—	20·27
	1928-29	260	—	21·38
Finland ...	1927-28	414	—	39·43
	1928-29	474	—	64·98
Norway ...	1927-28	190	—	186·93
	1928-29	172	—	171·11
Sweden ...	1927-28	286	—	65·67
	1928-29	242	—	66·89

Average prices required to meet the costs of production, compared with the average market prices current in 1930-31.

	Wheat	Potatoes	Beef	Pork	Butter	Cheese	Milk
Switzerland:			Swiss francs per kg.				
Prices required	0·46	0·15	1·99	2·45	5·18	2·66	0·27
Prices current	0·42	0·14	1·83	2·25	4·75	2·44	0·25
Sweden:			Swedish kronor per kg.				
Prices required	0·24	0·08	0·69	0·83	2·56	1·40	0·25
Prices current	0·20	0·07	0·58	0·70	2·15	1·18	0·21
Finland:			Finnish marks per kg.				
Prices required	0·28	—	0·79	1·23	2·92	1·95	0·16
Prices current	0·22	—	0·63	0·98	2·32	1·55	0·13
Denmark:			Danish kronor per kg.				
Prices required	0·14	0·09	0·71	1·13	2·61	0·75	0·13
Prices current	0·12	0·08	0·61	0·98	2·25	0·65	0·11
Poland:			Polish zloty per kg.				
Prices required	0·48	0·08	0·57	—	—	—	0·42
Prices current	0·32	0·05	0·38	—	—	—	0·28

A similar calculation referring to the year 1932-33, was made by the Central Office of Farm Accountancy in Soissons and refers to the position of the farms in the Soissons district in France. Here the relations between the prices needed to meet the costs of production and those current on 1st December 1932 were as follows:

	Prices needed (French francs)	Prices current
Wheat, per quintal ...	147·18	106
Sugar beet, per ton ...	176·77	150
Oats, per quintal ...	100	80
Mixed corn, per quintal ...	108	80
Straw, per ton ...	165	80
Fodder, per ton ...	411	220

Though these data have no pretension to being more than fair approximations, they are sufficient to show that the present lack of balance between prices and costs in agriculture cannot continue without causing the utter ruin of the agricultural industry. Either prices have to be raised, or costs reduced. But a further reduction of costs, even if it could be carried to such a point as to bring costs down to the present level of prices, could hardly be expected to make farming once again a paying occupation. The drastic application to agriculture of the principles of mechanisation and rationalisation, which alone could perhaps, provide a solution of this problem, apart from the purely technical difficulties which would often make it impracticable, would create fresh social and economic problems. Technically, seeing that farming is so largely a peasant industry conducted on family lines, and that even in large farms labour-saving devices can only be applied to a very limited class of operations, rationalisation and mechanisation in agriculture are set very much narrower limits than in most other industries. From the social point of view, a further extension of the application of labour-saving expedients, including changes in farming

systems which involve a reduction in the demand for labour, would be hardly desirable, in so far as it would be bound to increase agricultural unemployment and, in many cases, also to deprive the smaller peasantry of an important source of supplementary earnings, thus helping to undermine the economic position of the numerous class of semi-independent peasant farmers.

Accordingly, the price problem in agriculture, which has been outlined above in its principal aspects, would appear to be capable of satisfactory solution only by an increase in the prices of farm products, which would restore a normal relation between the prices and the costs of production.

Thus, practically all the measures taken by the Governments and the activities of farmers' organisation since the beginning of the present depression have been directed towards improving, as far as possible, the price situation on their respective markets. This they sought to achieve, in the first instance, by setting up systems of protection against foreign competition, by improving the organisation of agricultural marketing and, especially of late, by deliberately controlling production in such a way as to adjust the relations between supply and demand on their respective national markets or, in the case of some staple products, on the world market as well.

The history of the development of protection and other measures aimed at the control of the prices of farm products during the present depression has been told in our reviews of the agricultural situation and need not be recapitulated here. By the beginning of the agricultural year 1932-33, tariffs, often raised to prohibitive heights; milling quotas which imposed drastic restrictions upon the admission of imported grain in flour-milling; import quotas and licensing systems which involved direct quantitative restrictions upon the importation of agricultural products; prohibitions and monopolies; a complicated system of restriction of dealings in exchange, and, finally, such indirect but sometimes very effective expedients as measures of veterinary protection, constituted so efficient a system of barriers to international trade in agricultural products as to make the price movements of certain of the most important of these products on some national markets practically autonomous.

The prices of these products on markets so effectively isolated from foreign competition came thus to depend entirely on the relations between the home supplies and the internal demand, and the price level could be kept higher than in countries not so well protected. As an outstanding example of such price autonomy, one can point to the prices of wheat in Germany, France or Italy. In all these countries, and especially in Germany, the rates of general duties on wheat exceed more or less considerably the current prices of imported wheat in London and Liverpool, and other restrictions are also in force. In all these cases the wheat prices on the national market depend essentially on home supplies, and unless there is overproduction at home, they can be maintained at a level which makes wheat-growing remunerative. Yet it cannot be said that the policy of autonomous price formation has generally succeeded in solving the agricultural price problem on the markets in which it has been applied. Indeed, though the level of prices has been maintained on a higher basis than in

other countries, its gradual decline could not be prevented, and farmers continue to suffer from falling prices. This general tendency of the prices of farm products to decline is the natural effect of the all-round diminution in the purchasing capacity of the masses of consumers caused by the general economic depression which is itself largely due to the disintegration of the world market into isolated national economies. Against this decline no system of defences can protect the prices of farm products until the problem of international economic co-operation finds once again a satisfactory solution and the effective demand for foodstuffs and raw materials of agricultural origin is restored. Thus, the autonomy of price formation on national markets does not of itself provide a solution of the price problem even within the national economies concerned. Even should a market so isolated from outside influences be abundantly supplied with cheap credit facilities, this standard remedy against depression would hardly succeed in reviving the lingering agricultural industry, owing to the adverse effect which falling prices are bound to exercise upon the revival of confidence.

Accordingly, along with the continuance and further extension of protectionism, as applied to agriculture, the need for other expedients aimed at the better organisation and co-ordination of production and marketing of farm products has been increasingly making itself felt. The agricultural year 1932-33 has been particularly remarkable for this tendency towards deliberate co-ordination and planning of production and marketing, which linked the agricultural developments of the period under review with the **general trend towards planned economy.**

Elements of planning and organisation have, indeed, been very much in evidence in the recent agricultural policy of all countries which sought to assist their farmers and to restore agricultural production on a remunerative basis. Marketing schemes; pooling arrangements; cheap credit; moratoria and other arrangements to relieve the burden of debts; subsidies in different forms—all these measures continually extended the sphere of deliberate intervention of Governments in the conduct of the agricultural industry; but it was left to the more recent period to make definite steps towards the adoption of comprehensive schemes of deliberate re-organisation of farming.

The problem of planning in agriculture differs from that with which one has to deal in other industries in certain important aspects.

In the first instance, owing to the scattered nature of the agricultural industry which precludes the development of spontaneous organisation aimed at the control of production and marketing in agriculture, the part played in promoting co-ordination in farming by Governments is far more important than in other branches of production.

While in industry the pioneering work in planning has been done by business combinations formed by private initiative and pursuing the private economic interests of their promoters, and the Governments had often found necessary to combat these efforts as tending to restrict the freedom of competition and leading to the spoliation of the public by monopolies, in agriculture the reverse is the case. The Government has to start the scheme and, unless the producers are directly interested in loyally following the plan

by being paid for doing so, by no means save the intervention of public authority armed with sufficient sanctions can the observance of the scheme be enforced. Indeed, as the experience of the international schemes of control for rubber, coffee and tea has demonstrated, the attempt of control through producers' agreements are most likely to fail because, as soon as an initial rise in the prices of the product is achieved, an increase of production by outsiders encouraged by this improvement brings about a fresh collapse of the market. Such encouragement of production by outsiders, though it may take place in any other branch of production as well, in most industries is but a relatively remote contingency, because the existing concerns have interest in joining the scheme, while new concerns cannot be put in operation without considerable delay and the investment of large capital in a venture of which the success, in the eyes of the practised financier, would appear as more than problematical. In agriculture, in which unlike in industry, so large a part of the aggregate output of any commodity is contributed by small unorganised producers working with very little capital, interference with the scheme by actual or potential small producers outside the ring is a standing menace. When the scheme of control involves one of the great agricultural staples, largely produced in small peasant farms throughout the greater part of the globe, such as wheat, it has to be both initiated and carried out by the Governments, and its actual putting into effect presents difficulties almost insuperable, unless the Government finds a way of either making it a clearly profitable proposition for the farmer to obey, or otherwise penalises him directly for disobedience. The latter course, which involves such measures as supertaxation of all increases in cultivation, or some other form of deterrent of a financial nature, must necessarily be applied to the individual offender, and is therefore practicable only in the case of localised crops, where the changes in the cultivated area can easily be followed. In this way it has been possible, for instance, to check the excessive extension of vineyards by the imposition of heavy taxation on any increase in the cultivation of vines. But, while applicable to vine-growing such an expedient would be out of the question in the case of cereals or other crops cultivated on millions of farms all over the world. In the case of staple farm products, probably the only means by which the support of a scheme of reduction or limitation of crops by the mass of producers can be enlisted, is the creation of direct economic incentives for the growers to assist in its carrying out.

But planned economy, as at present conceived, does by no means necessarily imply a deliberate reduction of output either in agriculture or in any other branch of production.

When, in the past, the attempts at co-ordinating economic activities depended almost entirely on the initiative of private business combinations and had for their object the direct economic advantage of the industries so organised, the control of output with a view to maintaining a condition of relative scarcity on the market was the main purpose of planning, and planned economy was more or less identified with a systematic restriction of supply. Economic planning, as applied on a national scale by a Government, with a view to achieving greater stability in the economic system and to improving the economic and social conditions of the country generally, essentially implies a comprehensive scheme of co-ordination of economic activities. Such planning may involve a limitation of output in the

over-grown industries, as well as an increase of production in industries which lag behind the rest and must be expanded, if the balance within the economic system is to be achieved. Indeed, since the ultimate purpose of planning should always be to increase, and by no means to reduce, the wealth and prosperity of the community, the immediate object of planning should be the balancing of the various branches of production by increasing, rather than by diminishing, production all round. Restriction ought to be considered only in extreme cases, with regard to branches of production which have so far out-grown the existing capacity of the market for their products as to need pruning. During an economic depression, when relative overproduction in certain industries may have to be eliminated at all costs, in order to restore some sort of working balance in the economic system, planning, may have in the first instance to consider a reduction of output in the branches of production which have not kept pace with the diminution of output in other industries. But such policy of restriction, in a well conceived system of planning, can only appear as a temporary expedient, necessary to put the various branches of production in a state of initial equilibrium, and an effort at an all-round expansion of economic activities must constitute the next step.

This applies to farming more than to any other industry, since agricultural production during the depression, as we have had occasion to point out before, has refused to follow the general movement towards a diminution of output, and, in some cases, has actually increased its production. Here, as a temporary emergency measure, a reduction of output may be necessary in order to permit a return of farming to a condition of equilibrium between prices and costs; but it would be a fatal error to assume that economic planning in agriculture in future will have for its object mainly to keep the output of farm products within definite limits, as a means for keeping up prices.

Under normal economic conditions, agricultural production largely constitutes the limiting factor of economic expansion generally; and to keep it down would mean putting obstacles in the way of general economic progress.

Accordingly, a policy aimed at a restoration and normal expansion of economic activities, as the basis of prosperity and civilization, must necessarily aim, after an initial equilibrium had been restored by a temporary restriction of agricultural production, at creating conditions which would allow a fresh development of farming on a remunerative basis. This can only be achieved by a thorough co-ordination of deliberate policies with regard to the various branches of production, industrial and agricultural, to money and credit and to international economic co-operation.

It must be admitted that, though economic planning in agriculture had been steadily gaining ground in the course of the last few years, there was little sign of the need for such co-ordination being fully recognised. In farming, as in all the other industries, planning was being adopted empirically and was introduced not as part of a comprehensive programme of economic reconstruction, but in answer to the pressing demands of the situation. Agriculture faced with an unprecedented depression had to be helped, and Governments intervened with measures

of protection and assistance, sometimes far-reaching, but mostly designed *ad hoc*. Farming had to be protected from foreign competition, and this led to the gradual development of a vast system of tariffs, milling regulations, import quotas, licenses and so on, of which the original purpose was merely to ward off the pressure of imported agricultural products upon the home market. In countries exporting agricultural products, measures would be taken to organise and to improve the system of marketing, to reduce the production and the costs and, as far as possible, to regulate exports by international action with a view to supporting prices on the world market. Sometimes, both in the importing and the exporting countries it would be found necessary to relieve the plight of some particular branch of agricultural production by subsidies, guaranteed prices, export bonuses or other measures of financial assistance. Thus, agriculture would be more or less effectively helped out of its immediate difficulties, but these measures of assistance would not be welded together into a whole or co-ordinated with the other elements of the economic system. Yet, the network of various measures of assistance was bound, in the course of time, to develop into a system of which the functioning ceased to be automatic and governed by competition and demanded the continuance of Government intervention; and such intervention in the long run, could only be effective on condition that it was properly co-ordinated with the development of all other economic activities, both national and international. Agricultural policy, however, as a rule, was not co-ordinated with that pursued in respect of other branches of production; neither were the interrelations of the separate national economies brought into line with national economic policies to a sufficient extent.

Until the financial crisis of 1931 had largely done away with the fiction of the gold standard, there had existed a cleavage between the marked trend of economic and agricultural policy towards deliberate planning and control, and the nominal preservation of an international gold standard. This cleavage, though it may not have been generally acknowledged, was very painfully felt.

The essential purpose of planning being that of restoring and maintaining the balance in production, both between the different industries and between the prices and the costs in the particular industries, prices in planned economy are necessarily subject to the closest control. Yet price control is incompatible with the existence of an effective gold standard, since the proper functioning of the latter implies the automatic adjustment of prices to gold movements. In other words, planned economy necessarily involves a system of managed currency; and in fact the nominal gold standard which had existed since the stabilization had never been anything else than managed currency camouflaged as gold. The abandonment of the gold standard by many countries in 1931, followed by the depreciation of the dollar in 1933, and by measures which, in countries still keeping to gold, have made the gold standard technically and avowedly ineffective, opened the way to a more comprehensive policy of economic planning and permitted the movement towards planned economy to assume a more constructive aspect. The growing use of quantitative limitations of international trade, as well as the development of international contractual policy to which reference was made in the preceding chapter, along new lines, constituted further steps in the same direction, since in this way it was sought to bring international trade into line with national planning.

In the course of the year 1932-33, this new trend in the evolution of planning and co-ordination in agriculture has been particularly pronounced in the agricultural policy of the United States, under the present Administration, and of Great Britain where, under the National Government, planned economy is taking strong roots in farming.

The comprehensive character of the programme of reconstruction envisaged in the Agricultural Adjustment Act, approved by the U.S. Congress on the 12th of May 1933, appears both from its opening passages and from its contents.

The Act begins with a Declaration of Emergency, which runs as follows: "That the present acute economic emergency being in part the consequence of a severe and increasing disparity between the prices of agricultural and other commodities, which disparity has largely destroyed the purchasing power of farmers for industrial products, has broken down the orderly exchange of commodities, and has seriously impaired the agricultural assets supporting the national credit structure, it is hereby declared that these conditions in the basic industry of agriculture have affected transactions in agricultural commodities with a national public interest, have burdened and obstructed the normal currents of commerce in such commodities, and render imperative the immediate enactment of Title 1 of this Act."

Then follows the Declaration of Policy: "It is hereby declared to be the policy of Congress:—

1. To establish and maintain such balance between the production and consumption of agricultural commodities and such marketing conditions therefor, as will re-establish prices to farmers at a level that will give agricultural commodities a purchasing power with respect to articles that farmers buy, equivalent to the purchasing power of agricultural commodities in the base period. The base period in the case of all agricultural commodities except tobacco shall be the pre-war period, August 1909 to July 1914. In the case of tobacco, the base period shall be the post-war period, August 1919 to July 1929.

2. To approach such equality of purchasing power by gradual corrections of the present inequalities therein at as rapid a rate as is deemed feasible in view of the current consumptive demand in domestic and foreign markets.

3. To protect the consumers' interest by re-adjusting farm production at such level as will not increase the percentage of the consumers' retail expenditures for agricultural commodities, or products derived therefrom, which is returned to the farmer, above the percentage which was returned to the farmer in the pre-war period, August 1909 to July 1914.

This declaration of policy pursued by the Agricultural Adjustment Act is interesting as showing both the wide scope of the reconstruction aimed at, which while assisting the farmer, has to consider at the same time the interests of the consumer, and the essential foundations of the method by which economic balance in agriculture should be restored. Here, indeed, one has not only a declaration of policy, but an exposition of the basic principles of planning, as conceived by the authors of the scheme.

As in all planning, the object of the scheme is that of restoring and maintaining economic equilibrium, which, in the competitive system is an elusive condition of balance, which is never attained. Planning, if it is to achieve its purpose must get hold of this shadow and fix the terms of the equation which expresses it. When in devising a scheme of planning, one has to take some starting point, the only element of the equation one can get hold of, as a rule, is price, which, however, if it is to be used as the foundation of a system of planned economy, must be an equilibrium price. Since the state of equilibrium is a highly elusive condition, which price really represents it, it is exceedingly difficult to say. Accordingly, the Agricultural Adjustment Act adopts the expedient of referring to a normal "base period", which for all products except tobacco, is the period 1909-1914, during which price relations are considered as having been in a condition of equilibrium.

This is the way in which the Act seeks to solve one of the fundamental problems of planned economy, namely the definition *a priori* of the condition of equilibrium which it is essential to define with a fair degree of approximation in order to make planning effective. Without some fiction such as "normal periods" the problem can hardly be solved but such fictions have the unavoidable drawback of leaving out of account the changes in the relative positions of the various branches of production which may sometimes be so important as to make the present equilibrium prices quite different from those of the "normal" period. Thus, if within the intervening period the costs of production in various industries have not all been increased or lowered to the same extent, the margins of profit allowed under a scheme of equilibrium prices based on price relations of a "normal" period will differ very widely, and the balance will not be attained. This, undoubtedly, is a drawback inherent in the scheme adopted, in the Act, as well as in any other scheme of the same nature, which taken alone cannot be considered as an adequate theoretical basis for the determination of the equilibrium price relations.

The so-called Agricultural Adjustment Act contains three separate enactments, namely the Agricultural Act proper, the Emergency Farm Mortgage Act and the Act conferring upon the President extraordinary powers with regard to the issue of currency, the depreciation of the dollar to 50 per cent. of its gold parity and the coinage of silver dollars in a definite ratio to gold coins.

The Agricultural Adjustment Act provides for the reduction of the cultivation, in the first instance, of cotton, and then of any other agricultural products which the Secretary of Agriculture, may deem fit to include in the list, and of which wheat, maize, tobacco, rice, hogs and milk and dairy products are already provided for in the Act itself. In all cases, the farmers are induced to co-operate in the reduction of crops by the grant of direct financial benefits, which in the case of cotton consist in the option for the purchase of cotton at cost price from the Government stocks, offered to the growers who reduce their cultivation by 30 per cent. In the case of other crops, the farmers who agree to reduce their production in accordance with the Government scheme are given direct cash bonuses. The money necessary to defray the expenses of the scheme is collected by means of a processing tax imposed upon the industries engaged in the transformation of agricultural products.

The Emergency Farm Mortgage Act provides for the relief of mortgage debts burdening agriculture, for the liquidation of joint stock mortgage banks and for direct financial assistance to farmers with a view to the conversion of their existing indebtedness, of the redemption of foreclosed farms and of the provision of the necessary working capital.

Finally, the characteristic fact of the inclusion in the same document of the Act conferring upon the President extraordinary powers with regard to monetary policy, points to the recognition of the existence of close interdependence between the carrying out of the plan of agricultural reconstruction and the adoption of a definite monetary policy, which would help the work of adjustment by giving greater flexibility to the monetary system.

Another enactment passed under the present Administration is the Farm Credit Act of 1933. This Act has for its purpose "to provide for organisations within the Farm Credit Administration to make loans for the production and marketing of agricultural products, to amend the Federal Farm Loan Act, to amend the Agricultural Marketing Act, to provide for the obligations of the United States, and for other purposes."

This Act, in the first instance, provides for the improvement of the financial organisation of agriculture by the creation of twelve Production Credit Corporations and of twelve Banks for Co-operatives, one Corporation and one Bank in each city having a Federal Land Bank. In order to avail themselves of credit facilities provided by the Production Credit Corporations, farmers must combine in Production Credit Associations, through the medium of which such credits are obtainable. The Act also provides for the creation of a Central Bank for Co-operatives for loans to co-operative associations. The exact delimitation of the respective spheres of activity of the Central Bank and of the twelve regional Banks the Act leaves to the discretion of the Governor of the Farm Credit Administration.

The Farm Credit Act, though, unlike the Agricultural Adjustment Act, it does not contain any special programme of reconstruction based on definite principles, forms an essential part of the scheme of reconstruction, as a whole, in so far as it provides for the creation of special credit facilities for its carrying out and modifies certain enactments of the preceding period, so as to bring them into line with the plans now put into execution.

Considered in connection with the enactments which deal with other aspects of economic activity, and contain schemes for their deliberate reconstruction upon new lines, such as the Emergency Banking Act, the Unemployed Relief Act, the National Industrial Recovery Act and the other enactments and measures of the present Administration, the programme of agricultural reconstruction inaugurated in the United States in 1933 constitutes, in spite of its somewhat fragmentary character, the most comprehensive scheme of economic planning hitherto put into effect, except that of the Soviet Government in Russia, which, however, rests upon principles so entirely different as to make it a thing quite apart from economic planning elsewhere.

Great Britain provides important examples of economic planning in agriculture in the Wheat Act of 1932, which came into actual operation in the course of the agricultural year 1932-33, and in the Agricultural Marketing Act of 1931, under which certain marketing schemes have been put into effect in the course of the two following years.

The Wheat Act aimed at providing wheat-growers with a sufficient market for wheat and a remunerative price, without either paying a direct subsidy to the farmers or encouraging an excessive extension of wheat growing. A standard price of 45 shillings a quarter is fixed for home-grown wheat of millable quality and farmers are paid at the end of the year, on the wheat sold by them, so-called "deficiency payments," which represent the difference between the standard price of 45 shillings a quarter and the average price actually obtained by the grower on the market. Should the area under wheat be excessively increased, provision is made for the deficiency payments to be reduced in proportion to the increase in the quantity of wheat offered by growers over and above a norm which must not exceed 6 million quarters. The funds for defraying the payments to farmers are provided by the imposition of "quota payments" upon importers and millers of wheat. The scheme is operated by two bodies, the Wheat Commission, responsible for payments to farmers and for the administration of the scheme on the agricultural side, as well as for the control of the Wheat Fund consisting of the quotas paid by millers and importers, and the Flour Millers' Corporation. The latter body controls the Millers' Quota Fund, which is used for the purchase, at the end of the cereal year, whenever the Corporation is ordered to do so by the Minister of Agriculture, of the stocks of home grown wheat remaining unsold. This provision is designed to secure an assured market for the wheat-grower at home.

It may be seen, by comparing the scheme of the American Agricultural Adjustment Act of 1933, for the reduction of crops other than cotton with that on the British Wheat Act of 1932, that in both cases the payments made to farmers are made in a way which passes the charge to the ultimate consumer through the millers, importers or processors of the products in question without involving the Government in expense.

The development of deliberate planning and co-ordination in the production and marketing of agricultural commodities in Great Britain under the Agricultural Marketing Act of 1931 is another highly significant fact of the last two years or so.

The Agricultural Marketing Act provides for the organisation of producers of certain agricultural commodities for the purpose of securing control over the market. The initiative of proposing a marketing scheme must come from the producers themselves, who are also expected to submit a draft of the scheme for approval to the competent authorities. These are, for England and Wales, the Minister of Agriculture; for Scotland the Secretary of State for Scotland, and for schemes involving the whole of Great Britain, the two Ministers jointly. Should the producers not submit a draft scheme of their own, its drafting may be entrusted to a Marketing Re-organisation Committee specially appointed by the competent Minister. After examination by the Ministry, the scheme is referred back to the representatives of the producers, and it can only be proceeded with if all the modifications in it made by the Ministry are accepted by the majority of the producers' representatives. If and when the Scheme is accepted, it must be laid before Parliament. When passed, before it is actually put into effect, it is submitted to a poll of the producers affected by it, on the basis of registration, and the producers must poll two-thirds in favour of the scheme to enable it to come into operation, in which case it becomes compulsory for the minority.

The scheme is administered by a Board of Directors elected by registered producers. This body may take one of the following three forms: trading board, actually undertaking the disposal of the products affected by the scheme; regulating board, which does not engage in trading operations but instructs the producers as to the marketing of their products, in accordance with a general plan, and, finally, combined trading and regulating board which undertakes both these kinds of operations. The Boards are given very wide powers in the regulation of marketing and the control of prices. The running expenses of the schemes are met by a levy on the sales of the regulated commodities.

The Act, while it aims at securing a better organisation of producers and an improvement in prices, provides also for the protection of the interests of the consumers of the regulated commodities. For this purpose Consumers' Committees are created, which must watch the operation of the schemes on behalf of the consumers and can report to the Minister of Agriculture or the Secretary of State for Scotland. Any legal questions which may arise out of the application of the schemes are investigated juridically by Committees of Investigation appointed by the competent Minister.

So far, among the marketing schemes put into operation under the Agricultural Marketing Act the two most important are the Pig Marketing Scheme and the Milk Marketing Scheme. The former is interesting in that, besides the regulation of marketing of pigs and pig products of internal production, it is combined with a quantitative limitation of the importation of these products from abroad by import quotas, in such a way as to permit the expanding output at home to find a remunerative market.

Thus we have seen planned economy gradually penetrating into agriculture both in Great Britain and in the United States, where the recent development of this tendency was perhaps the most pronounced, the more so that, hitherto these two countries were the two most conspicuous supporters of the principles of free competition. On the Continent of Europe, Government intervention and planning, at least in some countries, have long been part of the scheme of economic development: but, until relatively recently, these activities have, on the whole been more or less closely fitted into the framework of a system which was essentially competitive. Since the beginning of the present depression, however, the situation in this respect underwent a marked change, since Governments nearly everywhere intervened in economic life with the clear intention of diverting its evolution from the course it would take under the pressure of competition into such other channels as they thought best in the national interest. As a result, in agriculture conditions have been created which, though they may more or less effectively protect the farmers from the full impact of the depression, depend upon the continuance of certain deliberate policies of encouragement and protection. As compared with the economic structure of the world under the competitive system, its present structure, in which deliberate planning and control are gaining ground continually, seems, indeed, highly artificial: but the very fact that it is so largely built up and held together by artifice or design would appear to insure its continuance, if not its permanence. The whole system on which the organisation rests, with its trade barriers, restrictions, compulsory regulations, and so on, has

become an integral part of the organisation of agriculture: and the buttresses which support this organisation cannot be removed without bringing ruin to whole populations.

In the organisation of agricultural production and marketing planned economy in order to be effective, must naturally extend beyond national frontiers, into the international field. The regulation of production and the control of the markets of the world's great agricultural staples, on which depends the well-being of whole countries, cannot be achieved without recourse to concerted international action.

In the international field, an outstanding example of economic planning is provided by the activities leading to the signing, in August 1933, of the Final Act of the Conference of Wheat Exporting and Importing Countries, commonly referred to as the Wheat Agreement.

The movement of which the Wheat Agreement was the outcome dated from the International Wheat Conference in Rome, in March 1931, at which the decision was taken by the wheat exporting countries to meet in London for the discussion of joint action aimed at the regulation of the wheat market. A special conference of wheat exporting countries was, accordingly, held in London in May 1931, but no agreement could be reached. For the next two years the problem remained unsolved, though the subject was broached again and again from different angles, until in May 1933, fresh exchanges of views were started by representatives of the four principal overseas exporting countries, namely the United States, Canada, Australia and the Argentine, in connection with the general preparations for the Monetary and Economic Conference. These negotiations, begun at Geneva, were later transferred to London, where they proceeded along with the meetings of the Economic Conference, though independently of the latter. During this stage of the discussions, the original initiators of the negotiations were joined, first, by the other exporting countries including the U. S. S. R. and then by representatives of the principal importing countries as well. The negotiations continued, with intermissions, until the 25th of August, when the Wheat Agreement was signed.

The Agreement provides for a reduction of exports of wheat by the exporting countries, applying to the crop years 1933-34 and 1934-35, while the importing countries agreed not to encourage the extension of their own wheat growing, to do everything in their power to increase the consumption of wheat and, when the prices of wheat have reached and maintained for a specified period a certain definite level considered as sufficient, to begin the lowering of tariffs and the removal of quantitative restrictions on wheat imports. A special Wheat Advisory Committee was also set up by the Agreement in order to watch its working and application.

In the building-up of the general framework of planned economy in its application to agriculture, far more important, however, than such multilateral agreements are the numerous bilateral commercial treaties between countries complementary to each other. By means of these bilateral agreements, more or less closely fitted into the national schemes of the countries concerned, the severed links between economic units belonging to different types, such as the industrial countries, on the one hand, and the mainly agricultural countries on the other, are being restored

on a new basis. As we have endeavoured to show in the preceding chapter of this study, competitive world economy, with the advent of national planning, tends to disintegrate and to be replaced by contractual international economic co-operation on the basis of reciprocity. Such a substitution of contractual relations for free competition is a necessary corollary of planned economy, and as far as international trade in the great agricultural staples is concerned, it brings this trade into line with the general trend of evolution of economic and commercial policy.

Countries which formerly kept their markets more or less wide open to foreign agricultural products, which they paid for out of the proceeds of the sale of their own manufactures and of the investment of their surplus capital all over the world, are now seeking, in the face of shrinking demand and of an unprecedented aggravation of competition among sellers, to assure for themselves some secure outlets, which, though narrow, as compared with their former world-wide marketing facilities, would at least be safe from the intrusion of outsiders. *Mutatis mutandis*, the same applies to the countries which have built up their economic system and founded their former prosperity upon the export of agricultural products. Trade relations between the industrial countries, on the one hand, and the agricultural countries, on the other, lose the fluidity which distinguished them under the system of free competition, and, for the duration at least of the international agreements by which they are determined, become more or less rigidly fixed.

The tendency towards the fixation of the terms of international trade relations between agricultural and industrial countries by agreements, either multilateral or bilateral, became clearly evident since 1931. The most conspicuous attempt made with a view to achieving a multilateral agreement on these lines was the arrangement proposed at the Conference of Stresa in September 1932 for the preferential treatment of certain determined import quotas of cereals from the agricultural countries of Central and Eastern Europe. The draft convention prepared by the Conference provided, however, on the instance of Germany, for the substitution, whenever any of the importing countries so wished, of participation in the fund of revalorization of cereals, by the conclusion of special bilateral agreements with the exporting countries with a view to providing a market for their cereals. In fact, by that time, Germany had already signed two such bilateral treaties, namely, one, in June 1931, with Rumania, for a reduction of tariffs on Rumanian barley and maize, and the other, with Hungary, in July 1931, for reduced rates of duty on Hungarian wheat imports. The Stresa Conference failed in achieving any positive results by multilateral agreement, the draft Convention proposed by it having never materialised; and though the question of multilateral regional agreements between the countries of Central and Eastern Europe has been cropping up repeatedly since then, any practical progress that has been achieved has been due to bilateral trade agreements.

These bilateral trade agreements involving, on one side at least, the exchange of agricultural products, take different forms.

In the first instance, they may be concluded direct between the Governments of the countries concerned and either stipulate for certain reductions in tariffs with regard to specified importations, or provide definitely for the admission of certain quantities of the products of one of the contracting

parties in exchange for the admission by the other party of a definite quantity of products of the other or of some specified concession or service. To the first of these two types belong the trade agreements signed in 1931, by Germany with Rumania and Hungary, the first providing for a reduction to 50 per cent. of the duties on barley and to 40 per cent. of the duties on maize imported from Rumania, and the second for a preferential duty of 75 per cent. of the general rate for wheat imported from Hungary. The second type is represented by some of the recent trade agreements concluded by the United Kingdom. Thus, the agreement of April 24th 1933 with Denmark provides for tariff concessions with regard to Danish bacon, butter, eggs, cream, and fresh and salt fish and contains a guarantee of certain minimum quantities in which, in case of the eventual introduction of import quotas for these products, they will still be admitted. In exchange, the United Kingdom obtained from Denmark tariff reduction in respect of certain of its products, as well as the undertaking that Denmark will meet 80 per cent. of its requirements of imported coal from British sources. In a protocol attached to the agreement, the contracting parties have engaged themselves, moreover, to take measures for increasing the sales in Denmark of British iron and steel. In the Agreement signed on the 1st of May 1933 between the United Kingdom and Argentina, the latter obtained guarantees of specified quotas for its importations of frozen and chilled meat to the former, as well as certain facilitations in connection with its frozen credits in the United Kingdom. In exchange, the United Kingdom is enabled to increase its coal exports to Argentina and to recover its frozen credits there, to the amount of nearly 10 million pounds sterling. The same principle of reciprocity is adhered to in the agreements concluded by the United Kingdom with Sweden, Norway and Iceland for the admission of the products of agriculture and fisheries exported by these countries.

In these agreements the more or less rigid determination of the quantities of the products exchanged and the strict reciprocity on which they are based are the two outstanding characteristics. They all would appear to constitute a half-grudging concession to the unavoidable necessity of international economic co-operation; and, with a view to enable the contracting parties to effect rapid re-adaptation of their foreign trade relations to the needs of national planning, they are, as a general rule, concluded for short periods or contain special provisions concerning the terms on which they may be denounced.

While the two types of agreement dealt with above, though they may introduce new principles into international trade relations, still leave the trade between the contracting parties to be carried on through the usual channels, the numerous barter agreements concluded since 1931 involve a complete departure from the traditions of the era of competitive world economy. In barter agreements we see a return to those conditions of direct exchange of commodities, in the form of barter or truck, which we have long been used to associate with the Robinson Crusoe parables of the classical textbooks of economics.

Unlike trade agreements in the proper sense, barter agreements have not all been concluded between Governments, though, as a general rule, they all have strong Government backing. Certain barter agreements have been concluded by the Governments with business organisations, either private

or semi-official, belonging to another country. An example of such agreement is that between the Brazilian Government and the Grain Stabilization Corporation and the Bush Terminal Company in the United States for the exchange of Brazilian coffee against American wheat. Besides, numerous barter agreements are concluded between private or semi-official business organisations in the two countries concerned, in which case the agreement technically may be considered as a private contract; but since it usually involves in the case of important transactions, the approval of the Governments concerned, as well as either a certain amount of Government supervision over its execution, or the granting by the authorities of tariff preferences or other facilitations, it acquires the character of a quasi-Governmental transaction.

Essentially, barter agreements do not represent a class of international agreements by itself, and are only a consequence of the difficulties in which international trade relations have been involved since the financial crisis of 1931 and the development of the strict control over dealings in exchange. They must, accordingly, be considered only as a specialised form of bilateral trade agreements which is recurred to under existing conditions to a considerable extent.

Whatever form bilateral trade agreements, as a means of restoring international economic co-operation, may take, they represent a concession made to the pressing need for such co-operation, a minimum of which is absolutely essential to keep the national economic units going. Accordingly, in the present stage of the evolution of planned national economies these beginnings of economic re-integration of the world through bilateral agreements between countries complementary to each other must not be given exaggerated importance. They are, indeed, so far, not so much concrete achievements as signs pointing in the direction of future evolution. And, indeed, it would be difficult to imagine in what other way the reconstruction of the essential interdependence between the complementary economies of agricultural countries on the one hand, and of industrial countries on the other, could possibly be effected. The process of such reconstruction is bound to be long and, for a considerable time ahead, till a high degree of economic integration is eventually achieved, to involve a more or less severe lowering of national incomes and of standards of life; but that this process has started, in agriculture as well as in other branches of economic activity, would appear to be unmistakably true.

SUMMARY AND CONCLUSIONS

Summing up what has been said above concerning the evolution of planned economy in the course of the last few years, under the pressure of the economic depression one comes to the following conclusions.

1. The progressive dissolution of the competitive system and the gradual substitution for it of a system based on deliberate planning and control of economic activities within more or less effectively isolated national economies, unavoidably brings about a diminution of national incomes and a lowering of the standards of life.

2. The future of planned economy accordingly depends upon the possibility of restoring international economic co-operation between planned national economies in a way which will bring this co-operation into line with national planning. Only by means of such a reconciliation between

national planning and international economic co-operation can a system be evolved which will permit the continuance of the existing standards of civilization and well-being.

3. The restoration of international economic co-operation can be conceived either as a return to competitive world economy by the abolition of the barriers which now impede international trade, or as the creation of a new system of international economic relations which would fall into line with the present trend of evolution of national economic policies. The first of these two alternatives has been repeatedly tried and has persistently failed because of the utter incompatibility of competitive world economy with the marked trend of national policies towards deliberate planning and co-ordination of economic activities. As, however, the pressing need for international economic co-operation between planned national economies makes itself increasingly felt, modern commercial policy tends gradually to forge new links between the now largely isolated national units by the development of contractual co-operation between countries economically complementary to each other. By bilateral agreements, by regional and other preferences and by the development of exceptions to the most-favoured-nation clause, involving a return to the principle of reciprocity in international economic relations, a new system of international economic co-operation is being evolved. This new system based upon contractual relations between complementary economies, will fit in with the system of national planning and may eventually bring about the re-integration of world economy on entirely new lines.

4. Agriculture is deeply involved in this general progress towards planned economy. The central problem with which it has to contend is that of the prices of agricultural products in its various aspects. It is accordingly, to the solution of this basic problem that the planning efforts are primarily directed.

5. Planned economy in agriculture presents certain peculiar aspects, which distinguish it from economic planning in other branches of production. It is often erroneously assumed that agricultural planning must necessarily aim at a reduction of output with a view to maintaining or raising prices, while, in fact, its essential purpose must be that of achieving economic balance between the various industries and between supply and demand on a level that will involve an all-round increase of prosperity. Incidentally, to attain a condition of initial equilibrium from which to start, economic planning in agriculture may involve a reduction of output in overgrown branches of production, but only as a temporary expedient, to be followed by a policy of co-ordinated expansion.

6. National planning in agriculture, as well as in other industries, has to be supplemented by international economic co-operation co-ordinated with national efforts. The most important development in the direction of restoring economic co-operation between agricultural countries, on the one hand, and industrial countries on the other, is the recent evolution, in this domain and elsewhere, of contractual economic relations between economic units complementary to each other. This development, now still in its early stages may eventually lead to the re-integration of world economy, which cannot be achieved until the relations between agriculture and industry are fully restored. Until this re-integration is well advanced the national incomes of both the industrial and the agricultural countries will be reduced and the standards of life will remain below their normal level.

REVIEW

"The Coconut Industry of Travancore," *by S. Raman Kutty Menon, B.A., Quilon S. R. V. Press 1933. Price Re. 1.*

THIS is an economic study compiled by a Travancorean with a sympathy "for the thousands of poor women and children on the Travancore seaboard landscape . . . . eking out an existence through one or other of the manifold blessings of the coconut palm." At the same time we are told that its contents are applicable to conditions in Cochin and British Malabar. The book should be of interest in Ceylon especially at the present time. The population of Travancore is shown in an analysis to be about the same as that of Ceylon but among the 5,095,973 inhabitants more than half are classed as people who do not earn anything ("non-workers") and only 1,478,652 as self-supporting individuals in the State. Of the population 67,423 are said to be engaged in the Coir Industry. Many of the tables and graphs in the book would be more valuable if the years to which the values in British rupees and other data applied were not often given in the Mysorean Era. In the absence of any comparative statement this is tantalising to those who would use the book.

The coir industry in Travancore is such that its annual value is about equivalent to that of the coconut kernel products whilst in Ceylon the other products are some two and a half times the value of the coir. The earning capacity of the Travancorean engaged in the coir industry is put at 4 annas (25 cents Ceylon money) a day for a woman beating husk and 6½ annas for a man engaged all day in making yarn. The economic condition of these people is in no way consoling, they are subject to the ill-effects of floods once a year as the result of being on a seaboard with a rigorous monsoon. Malaria is rife, tolerably good drinking water is absent and the revenue of the State is largely derived from exports. The export duty on coir yarn has, it is said, the tendency to divert some 40 per cent. of it through the matting factories of Alleppy whence it gets exported free in the manufactured form. The export duty on coir yarn brings in about Rs. 5 lakhs to the State. The booklet is an interesting study at the present time.

MEETINGS, CONFERENCES, ETC.

TEA RESEARCH INSTITUTE OF CEYLON

Minutes of the Meeting of the Board of the Tea Research Institute of Ceylon, held in the Ceylon Chamber of Commerce Rooms, Colombo, on Thursday, the 12th April, 1934, at 10-30 a.m.

Present.—Mr. Jas. Forbes (Jnr.), (Chairman), the Director of Agriculture, (Dr. W. Youngman, D.Sc., Ph.D), Messrs. A. G. Baynham, R. G. Coombe, E. L. Fraser, C. E. Hawes, D. T. Richards, B. M. Selwyn, J. W. Thompson, R. R. Muras (Accountant), A. W. L. Turner (Secretary) and by invitation Dr. Roland V. Norris (Director, T. R. I.), and Mr. J. W. Ferguson (Visiting Agent).

Absent.—The Hon'ble the Financial Secretary, Col. T. G. Jayawardene, V.D., M.S.C., and Mr. D. H. Kotalawala, M.S.C.

1. Notice calling the Meeting was read.

2. The Minutes of the Meeting of the Board of the Tea Research Institute of Ceylon, held on the 13th January, 1934, were confirmed.

3. MEMBERS OF THE BOARD OF THE T. R. I.

Announced that Mr. D. T. Richards returned from leave on the 19th March, 1934, and relieved Mr. F. A. Bond, who had been acting for him.

It was decided to thank Mr. Bond for his services.

The Chairman welcomed Mr. Thompson and Mr. E. L. Fraser, who had been nominated by the Ceylon Estates Proprietary Association to act for Messrs J. C. Kelly and I. L. Cameron, who proceeded on furlough or the 28th February and 21st March, respectively.

He added that Mr. Thompson would proceed on furlough on the 2nd May, and as Mr. Kelly was returning to the Island shortly after that date, the Ceylon Estates Proprietary Association had re-nominated Mr. Kelly to act on the Board until Major Oldfield's return in August.

Finance Sub-Committee.—Announced that Mr. Thompson had acted for Mr. Kelly on this Sub-Committee, and the latter gentleman would be asked to resume his seat on his return to the Island.

4. FINANCE

(a) The Chairman stated that since the last Meeting the Accounts for December, 1933 and January and February, 1934, had been sent to each member of the Board.

(b) *Audited Statements of Accounts for* 1933.—The Accounts were considered satisfactory and approved.

(c) *Election of Auditors.*—Messrs. Ford, Rhodes, Thornton & Co., were unanimously re-elected Auditors.

(d) *Water Supply.*—The Chairman was authorised to obtain details of a scheme for improving the Water Supply at St. Coombs. This appears to be an urgent matter owing to the amount of sickness which has been prevalent amongst those living on the Institute's property.

Mr. Coombe stressed the urgency of the matter and suggested that the proposed scheme should be drawn up as soon as possible and circulated to the Members of the Board for comment.

The Chairman suggested that it would be quicker if the Finance Sub-Committee were authorised to deal with it.

This was agreed to.

(e) *Additional Votes. Kieldahl Room.*—The Director reported that one of the fume cupboards was worn out and it was impossible for anyone to work in the room when certain experiments were in progress. As the fumes were very acid, a fan made of incorrodible metal was necessary. The cost thereof would be approximately Rs. 150/-, and the total cost of the necessary alterations would amount to about Rs. 500/-.

The expenditure was authorised.

(f) *Rs. 300/- under Estate Item 34—Pests.*—It was pointed out that there were a number of areas on the estate from which root disease was spreading. It was estimated that accurate mapping of these areas and treatment of the same would cost approximately Rs. 300/-.

The additional vote was granted.

5. TEA CESS

The Chairman stated that the Planters' Association of Ceylon had already supported the suggestion that the Cess should be maintained at 14 cents, and he had written to the Ceylon Association in London, the Ceylon Estates Proprietary Association and the Low-Country Products Association asking for the support of these Associations.

He pointed out that at the moment one officer was in charge of the Entomological, Mycological and Plant Physiological Departments, and if the Board wished to retain a full staff of scientists including an Entomologist every effort must be made to maintain the Cess at 14 cents, because any reduction would necessitate a reduction of senior staff. He added that the Finance Sub-Committee had discussed the matter just prior to the Meeting of the Board and had unanimously decided to recommend that the Board should do its utmost to ensure that the Cess is maintained at 14 cents until 31st December, 1938.

The proposal was carried unanimously.

6. SENIOR SCIENTIFIC STAFF

(a) *Entomologist—Mr. C. B. R. King.*—Announced that Mr. C. B. R. King proceeded on 8½ months' leave on the 4th April, 1934, prior to severing his connection with the Institute.

(b) *Plant Physiologist—Mr. F. R. Tubbs.*—This Officer's application for leave as from the 31st October, 1934 to the 3rd August, 1935, in accordance with his agreement, was sanctioned.

It was further decided that Mr. Tubbs' agreement which expires on the 3rd March, 1935, should be renewed for a further period of 5 years.

(c) *Tea Technologist—Mr. J. Lamb.*—Announced that this Officer took up his duties on the 12th February, 1934.

7. JUNIOR STAFF PROVIDENT FUND

Election of Trustee in place of Mr. Jas. Forbes (Jnr.).—The Rules of this Fund lay down that the Trustees shall be the Chairman of the Institute, one other member of the Board elected by the Board, the Director of the Institute, the Secretary of the Institute, and one member of the Junior Staff nominated by the Junior Staff.

Prior to Mr. R. G. Coombe retiring from the Chair, Mr. Jas. Forbes (Jnr.) was the Board's Nominee and as he had now assumed the Chair, there was a vacancy.

It was unanimously agreed that Mr. R. G. Coombe be elected a Trustee as the Board's Representative.

8. MEDICAL SUB-COMMITTEE

Announced that the Report of this Sub-Committee had been sent to each member of the Board on the 5th instant (Circular No. A. 9/34).

The Chairman stated that the Finance Sub-Committee had considered the Report just prior to the Board Meeting and had decided that as the suggestion had far-reaching ramifications it would recommend to the Board that the subject be postponed until the next Meeting.

This recommendation was adopted.

9. EXPERIMENTAL SUB-COMMITTEE

The Chairman stated that this Sub-Committee had met at St. Coombs on the 27th January. The Minutes of that Meeting had been sent to each Member of the Board.

In connection with Pruning Experiments, Dr. Youngman stated that he was quite willing to grant facilities for the continuation of pruning experiments at Peradeniya for a further period of two years.

10. ST. COOMBS ESTATE

(a) *Superintendent.*—Announced that Mr. Rogers is proceeding on 8½ months' furlough on the 18th April.

(b) *Acting Superintendent.*—Announced that Mr. E. J. K. Garthwaite who had been selected by the Sub-Committee appointed for this purpose, *vide* Cir. No. B. 4/34, had arrived on the estate on the 9th instant.

(c) *Tea Samples.*—It was decided to write to Messrs. Wilson, Smithett & Co., Tea Brokers, to thank them officially for having complied with the Board's suggestion that quarter pound sample packets of St. Coombs teas should be sent to them for their report and retention of the samples for inspection by those interested in the Institute.

11. PUBLICATIONS

The Board confirmed its decision, which was taken by circulation of papers (Cir. No. B. 1/34) to the effect that copies of all Publications issued by the Institute could be sent free of charge as and when requested to Directors and Proprietors of Tea Estates.

12. ANNUAL REPORT FOR 1933

Announced that a copy of the Secretary's portion of the Annual Report for 1933 was sent to each member of the Board on the 31st January, 1934. A copy of the Report was sent to the Minister for Agriculture and Lands on the 28th March, through the Director of Agriculture.

13. ANY OTHER BUSINESS

Under this heading the Secretary was instructed to write to Mr. G. H. Callender and thank him for allowing the Institute to use his private cart road during the time that the St. Coombs cart road bridge was closed for repairs in March.

The Meeting closed with a vote of thanks to the Chair.

A. W. L. TURNER,
Secretary.